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PRODUCING PVC RESIDENTIAL BUILDING PRODUCTS IN ALBERTA

Alberta
MUNICIPAL AFFAIRS
Innovative Housing Grants Program

[redacted]

PRODUCING PVC RESIDENTIAL BUILDING PRODUCTS IN ALBERTA

March, 1988

Prepared by:

HLA Consultants

The views and conclusions expressed and the recommendations made in this report are entirely those of the authors and should not be construed as expressing the opinions of Alberta Municipal Affairs.

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FOREWORD

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As the type of project and level of resources vary from applicant to applicant, the resulting documents are also varied. Comments and suggestions on this report are welcome. Please send comments or requests for further information to:

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EXECUTIVE SUMMARY

The objectives of this study are to identify and document the feasibility of producing Polyvinyl Chloride (PVC) residential building products in Alberta. While other PVC residential building products are addressed, the study focuses primarily on siding and window frames. The study also addresses the feasibility of establishing a plant in Alberta and details the production requirements.

The methodology includes the following:

- review of sources of PVC resins and processes that are necessary before products can be produced;
- identification of the range of building products that can be produced from PVC resin;
- analysis of the markets for the products in general and specifically for an Alberta based producer;
- examination of the financial viability of an Alberta based PVC building product manufacturer; and
- review of the technical aspects of production.

The work was achieved through an extensive review of the available literature and through personal contact with producers and representatives of plastic and vinyl organizations. Although this research is based on the best information that is available at this time, it is important to note that plastics are a relatively new industry. Also the PVC building products industry is generally characterized by a small number of relatively large producers. As such there is not the same abundance of information as there is for other industries. Since it is a very dynamic industry, producers tend to guard their information and operations fairly closely.

The results of this research are intended to provide general guidelines for potential producers and others who are interested. Given the rapidly developing and dynamic nature of the markets for PVC building products and

given the large investment required to establish a viable production facility, a more detailed market and production analysis than is presented here, is recommended for a potential producer.

The major end uses of Alberta PVC are pipe, siding and windows. The pipe market in Alberta is well served by two large Alberta based producers. Another Alberta producer would find market penetration difficult unless demand for the product increased substantially. There is one PVC window extruder in Calgary and no PVC siding extruders in Alberta. Both of these have some production potential for a new Alberta plant. Other products that were examined include vinyl shutters, PVC fencing, mobile home skirts, interior trim, flooring, wall surfacing and roof drainage. However, in view of funds available, the primary focus was directed towards the major end uses of PVC.

An analysis of production and markets shows that a plant located in Northern Alberta, at or near Edmonton, which produced both PVC siding and window frames could likely capture a sufficient share of the market to make production viable. Long term production feasibility may be even better than that indicated in this research, since many product innovations are occurring and the demand for plastic products appears to be generally increasing. As well there is a possibility such a plant could also produce some of the items that were not considered in great detail, such as roof drainage products.

1.0 INTRODUCTION

1.1 Background

A 1985 study of Alberta Building products noted that while Alberta produces large quantities of PVC resin, this product is for the most part, bulk shipped out of province and then re-imported. Yet Alberta has a shortage of PVC building products.

There is a growing market for PVC building products. This can be attributed to the fact that PVC products are relatively new on the market and that they have certain desirable characteristics relative to more conventional products. These characteristics relate to price, durability, and other specific product characteristics.

The major PVC products that can be applied to residential building purposes are plumbing and fresh water pipe, siding, and windows. Other products with potential include; shutters, fencing, roof drainage, skirts, roof cooling systems, interior trim, flooring and wall surfacing.

Some of these products are manufactured in Alberta. Others are imported and thereby represent possible Alberta production opportunities. This is especially true when export potential is also considered.

1.2 Objectives of the Study

The overall objectives of this study are:

i) to identify building products that might be produced using PVC resin and specify their characteristics;

ii) to examine markets and market characteristics for the PVC building products;

iii) to analyze the competitive situation for PVC building products in Alberta relative to other manufacturers and substitute products;

iv) to identify production requirements and costs of producing promising PVC building products; and,

v) to detail the operational features for a plant.

1.3 Methodology, Approach and Organization of the Material

The research focuses upon realizing economic opportunities for new or increased production of PVC building products in Alberta. The major focus is on the three main PVC product lines; pipe and plumbing, vinyl siding and window frames. Secondary PVC building products, such as flooring and fencing, are also examined briefly.

The research began with a review of the origins and sources of PVC resins and the processing that is required in the form of compounding before it is ready for manufacturing into its final products. General characteristics of PVC are identified and discussed.

The next step was to identify the potential types of building products that can logically be manufactured from PVC resins. The characteristics of the products and alternative products are identified and discussed. The pros and cons of the PVC products relative to its substitutes are assessed.

The research then focused on the markets for PVC building products. This began with a general overview of residential construction as being a major factor that affects demand for PVC as well as other building materials. Historical and future demand for PVC building products in general were then assessed. This was followed by a separate market analysis for specific PVC building products. Conclusions were then drawn as to which products could feasibly be produced based on a market perspective.

The final phase of the research involved an evaluation of production characteristics for producers of these products. This included specification of all operational parameters including costs of production and scale of plant.

The main research sources were interviews with company experts, literature searches, use of Statistics Canada and Alberta Bureau of Statistics materials, University of Alberta library, Northern Alberta Institute of Technology (N.A.I.T.), and the various Canadian vinyl and plastics associations.

Meetings were held with various representatives from the PVC building products industry. These included PVC pipe manufacturers, vinyl window extruders, vinyl window fabricators and distributors, vinyl siding manufacturers and distributors, the Vinyl Council of Canada, the Plastics Society of Canada, raw resin manufacturers, PVC compounding plants, Northern Alberta Institute of Technology Plastics Department, the Federal Business Development Bank, PVC extrusion equipment manufacturers, PVC product manufacturers, Transportation Services of the Alberta Government, Revenue Canada, Alberta Treasury, and Canadian Pacific Railways. As well, some of the larger manufacturers in Toronto and Winnipeg were visited.

2.0 POLYVINYL CHLORIDE AND ITS PRODUCTS

In this section a description is provided of PVC, how it is produced, the compounding process that is required of the PVC resin before it can be manufactured into different products, and the alternative building products which can be manufactured using the resin. As well, the characteristics of the resin and its manufactured products are described.

2.1 Polyvinyl Chloride (PVC)

PVC is a product that is produced from natural gas, oil and salt. It is manufactured through a highly complex series of chemical processes. In Alberta, there are several separate plants in a petro-chemical chain that convert the natural gas feedstock to the final form of PVC resin.

The final link in the PVC manufacturing process is the B.F. Goodrich plant located near Fort Saskatchewan. It is a large plant, the only PVC resin plant in Alberta, and sells its product throughout Canada. Only about 20-40 percent of the PVC resin is used in Alberta. The rest is primarily sent to Eastern Canada. A limited amount is sold out of Canada.[1]

The PVC resin, as it leaves the plant, is not suitable for manufacturing into alternative building products. At this stage it is brittle and breaks down at relatively low temperatures. It must first go through an additional process called "compounding". Compounding is a process whereby additional substances are added to the resin to improve its working properties and give it specific physical characteristics.

Substances such as plasticizers, colors, and fire retardants are added to allow the plastic to be extruded into the various shapes and colors that are desired.

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1. B.F. Goodrich sources.

The process of compounding is itself a very complex and expensive process. For this reason, only larger manufacturers do self-compounding. Other manufacturers purchase the compounded PVC resin from plants that specialize in this process. One of the Alberta pipe manufacturers, Sceptor, compounds its own resin. There is one commercial compounding plant, Carlew, located in Calgary. Other than Carlew, compounded resins used in Alberta are bought from plants in Ontario.

Compounding is not a standard process that results in a standard product. Various substances can be added to the original resin to provide a compounded resin which has a range of working properties and physical characteristics.

PVC's characteristics and properties make it an ideal building material. The following are some of its advantages relative to other building materials:

- slow aging - does not rust like steel or warp like wood. Because color is mixed in PVC extrusions, it does not require painting, the surface will not strip, chip, peel, blister, or corrode;
- easy maintenance - easily cleaned with mild detergent and water;
- resistance to corrosion - PVC is chemical resistant;
- pleasant appearance - range of colors and styles to choose from;
- material control (texture, color, translucency);
- good acoustical properties;
- heat insulation - PVC acts as a natural insulator; cool in summer and warm in winter; unlike aluminum, PVC does not transmit heat or cold, which can cause frost and condensation;
- fire control - fire retardants can be mixed into extrusion process;
- does not conduct electricity;
- dimensional stability - can be flexible or rigid;
- chemical control - can be controlled chemically for various desired properties;

- ease of fitting - components can lock or snap into place; and,
- mass production - easy control of required volume and inventories.

2.2 Product Types and Characteristics

There are many different PVC products that can be manufactured for residential building construction. Most are identified below and their characteristics presented.

2.2.1 Vinyl Windows

Window frames are often made of PVC. The PVC is usually used with a metal core for stiffening. This provides for a frame that does not warp or decay like wood, or rust like steel.

Vinyl windows have many advantages. Since the windows are made of rigid vinyl extrusions, with color all the way through, no painting is required. This reduces total installation time and eliminates any on-site finishing work. Each sash section of these windows is designed to be simply removed by the homeowner for easy cleaning or glass replacement.

Vinyl windows do not deteriorate physically as rapidly as windows made from other materials. They do not experience wet-rot fungus, and they will help reduce heating bills by reducing the conduct of heat and cold. Vinyl windows also are an effective sound barrier. They are maintenance free and require only a mild detergent to restore them to a new condition. Because they are a solid color throughout, the surface will not strip or chip and so do not need to be painted.

2.2.2 Vinyl Siding

To avoid the maintenance problems of wood siding, several competitive siding materials have appeared on the market. They are chiefly aluminum and rigid PVC. PVC siding is produced by extruding PVC into the shape of a siding. The color is mixed into the resin before extrusion, and thus is permanent. Vinyl, like aluminum, made its residential reputation in remodelling. According to the Society of Plastics Industry, a trade association, vinyl siding is being used increasingly in new housing construction. In 1967 only two percent was used in new construction, but by 1977 this had increased to 10 percent and by 1980 it was at 25 percent. This progression has been similar to that experienced historically by aluminum.

Currently, the most popular siding materials are brick and aluminum, each with about 20 percent of the total market. Wood, which has high maintenance requirements follows closely. The Society of Plastics believes that vinyl will catch up in five years. Figure 2.1 indicates the growing market acceptance of vinyl siding from its initial manufacture to 1980. This growth is also attributable to the fact that many improvements have been made in vinyl siding in the past ten years.

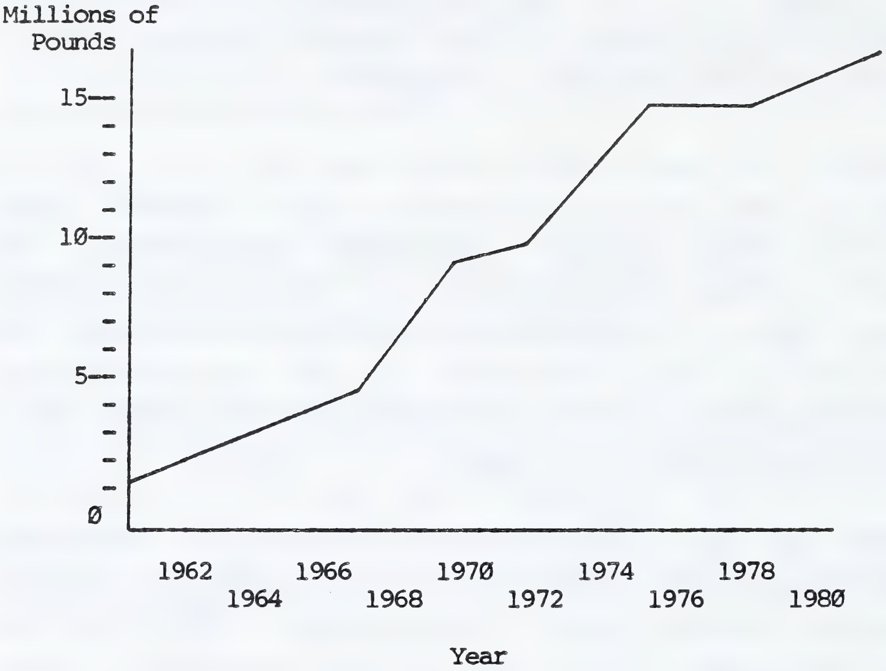
Perhaps the most significant factor has been price. Whereas many other kinds of siding have shown sharp price increases, vinyl has remained relatively stable. Consequently, vinyl is now price-competitive with other quality, pre-finished exterior sidings.

The most interesting innovations have come in new colors. At first only white was available. Now gray, yellow, soft green, and other light shades are available. An even broader range of colors are expected to be introduced soon.

Because the color is uniform throughout, the pigment cannot be scratched off. There is no chipping, flaking, peeling or blistering. Nor does vinyl rust, pit, corrode, interfere with TV reception or attract termites. As a natural insulator, vinyl siding helps keep a home cooler in summer and warmer in winter.

Figure 2.1

Canadian Vinyl Resin Consumption in Exterior Construction
(In Millions of Resin Pounds)
1962 - 1980



Source: B.F. Goodrich Chemical Co.

If vinyl gets dirty, it can be wiped clean with common detergents and water. Because it does not conduct electricity readily, it does not need to be grounded. Light and flexible, vinyl is easy for workmen to handle and quick to install. Standard tools and equipment can be used. A snap-lock system is also available.

Vinyl siding can be painted if the owner wants to change the color scheme. A latex paint is usually recommended. However, painting destroys the big advantage of vinyl, which is freedom from painting, flaking, peeling and chipping.

There are two problems with using vinyl siding. One is its tendency to shatter on impact when it is very cold, and the other is its relatively large expansion rate if it is dark colored, and heated directly by the sun. Table 2.1 presents the thermal expansion properties of alternative construction materials. PVC is substantially higher than other materials. This suggests that care must be taken in installation and choice of colors.

Table 2.1

Thermal Expansion of Various Building Materials
in Inches per 100 Ft. Length at 100 Ft.

Brick	0.36
Glass	0.54
Concrete	0.66
Steel	0.72
Aluminum	1.46
PVC Vinyl	3.60

Source: Construction Materials, W.J. Patton, Prentice-Hall, 1976.

2.2.3 Pipe and Plumbing

Pipe is by far the largest single application for PVC resins, representing 40% of the total PVC market. PVC pipe is used for pressurized drinking water, drain/waste/vent, irrigation, and sewer applications. It also is used for electrical conduit and for molded pipe fittings.

PVC pipes are now accepted as suitable for cold water piping. Because of their smooth inner surface there is less chance of their freezing up. When water freezes it expands, and it is then that lead or copper water pipes crack. With PVC piping, the expansion of freezing water is taken up by the pipe because the PVC is more flexible than metal. The water is also less likely to freeze, as plastics conduct heat more slowly than metals.

PVC plumbing offers low weight and simple installation. The water distribution piping is bendable enough that it may conform to the irregular contours so prevalent in rehabilitation projects. A semi-skilled tradesman can install these materials relatively easily.

Numerous all-vinyl plumbing systems have been utilized in rehabilitation projects. Rigid vinyl drain, waste, vent piping and rigid chlorinated vinyl, or CPVC, has been used for hot and cold water distribution.

A variety of PVC pipe diameters can be manufactured. All that is required is variation of the size of the extrusion molds. At this time, smaller diameter pipes are manufactured more commonly than larger diameters. This relates to price, awareness, availability and other demand variables that will be addressed in more detail in a following section.

PVC pipe also can lower the temperature of roofs by spraying mist. A PVC spraying system works effectively with or without air conditioning to substantially reduce solar heat on the roof and radiant heat from the hot underside of the roof.

2.2.4 Vinyl Shutters

Vinyl shutters are easy to install and maintain, and are durable. They are often made of vacuum-formed vinyl over a treated wood sub-frame and wood centre for added rigidity. The vinyl skin is complete in one piece with no seams, and boasts of high impact resistance, low maintenance requirements, and crack, chip and peel resistance. Vacuum forming gives clean details at corners and can produce a natural pine-grain appearance. The shutters are currently available in black or white, louvered or panelled design, and in a variety of heights and widths.

2.2.5 PVC Fencing

Vinyl fencing can be attractive, is maintenance-free, and durable. It is currently available in two and three rail designs for commercial, industrial, municipal, farm, and residential use. This post-and-rail fencing absorbs sizable impacts, resists abrasion and insects, and is suitable for use in adverse soil conditions. Painting and other preservation is not needed. The fence consists of interlocking five-foot sections that assemble easily without nails, bolts, screws or special tools.

2.2.6 Mobile Home Skirts

Rigid-vinyl ground curtain walls provide protection to, and enhance, the appearance of mobile homes. They are resistant to dents and scratches, and have flame retardant properties.

2.2.7 Interior Trim

Cellular vinyl moldings can be installed in a similar way to that of wood. The basic advantages of PVC moldings are: they do not crack or splinter when being handled or installed; and, they can be shaped to fit slightly irregular contours. They are also pre-finished, and therefore do not have to be varnished or painted.

2.2.8 Flooring

Vinyl sheet goods are installed without difficulty. Large widths of up to fourteen feet are available and greatly simplify the skills and time needed for floor covering installations. The result is practically seamless floors. The primary advantages of vinyl flooring are the wide range of available colors and patterns, a moderately high degree of durability, and low initial cost.

2.2.9 Wall Surfacing

Used in bathrooms around the tub and shower areas, vinyl sheet materials are easy to clean and have no seams to collect oils, dirt, and bacteria. PVC tub enclosures are excellent alternatives to materials such as ceramic tile.

2.2.10 Roof Drainage

Historically gutters and downspouts have been mostly made from sheet metal. However, in more recent years plastics have slowly been introduced for this purpose and have made significant inroads into this market. Because of its superior characteristics, plastic has tremendous potential for this purpose.

In discussions with a vinyl eavestroughing outlet in Edmonton, they indicated that PVC eavestroughs and downspouts comprise 7% of the total market. They also indicated that their market consists mostly of the renovation market. This is due to the fact that most contractors in new housing choose aluminum eavestroughs because they are quicker to install, and three or four houses can be done per day, whereas PVC eavestroughs take longer to install. However, most people who are renovating, choose PVC eavestroughs because of their low maintenance (no painting or scaling), and because of the ease of installation and application (do-it-yourself). A study done by Regional and Industrial Expansion, indicates that expenditures in the renovations market have been increasing[1]., thus the potential demand for PVC eavestroughs and downspouts, should see an increase, along with the increase in the renovations market.

2.3 Alternative Materials

Vinyl is an alternative building material. All of the products discussed above can be manufactured from a variety of products. Table 2.2 provides a listing of standard and alternative materials for a variety of building products.

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[1] "The Demand for Residential Renovation For Selected Wood Based Building Products", Regional and Industrial Expansion, September 1986.

Table 2.2

Alternative Building Materials by Usage

Product	Standard*	Alternative(s)**
Window Frames	Aluminum/Wood	Steel/Vinyl
Eavestroughs/ Downspouts	Pre-finished Alum.	Galvanized Steel Pre-finished Steel Vinyl Wood
Siding	Brick Aluminum	Hardboard Siding Vinyl Siding
Patio Doors	Alum. Clad Wood Frame	Vinyl Clad Wood Frame Plain Wood Frame
Resillient Flooring	Sheet Vinyl Goods Flooring Adhesive	Rubber/Vinyl Base
Pipe and Fitting/ Accessories	Copper Plastic	Cast Iron

* Standard Material: Standard system of materials measured. Most commonly used by builders building modest tract housing or rental accommodation.

** Alternative Material: Alternate material that can be used in place of the standard materials but not as commonly used as standard material.

Source: Alberta Residential Building Products, 1985. Alumni-News, April, 1986.

3.0 MARKET ASSESSMENT

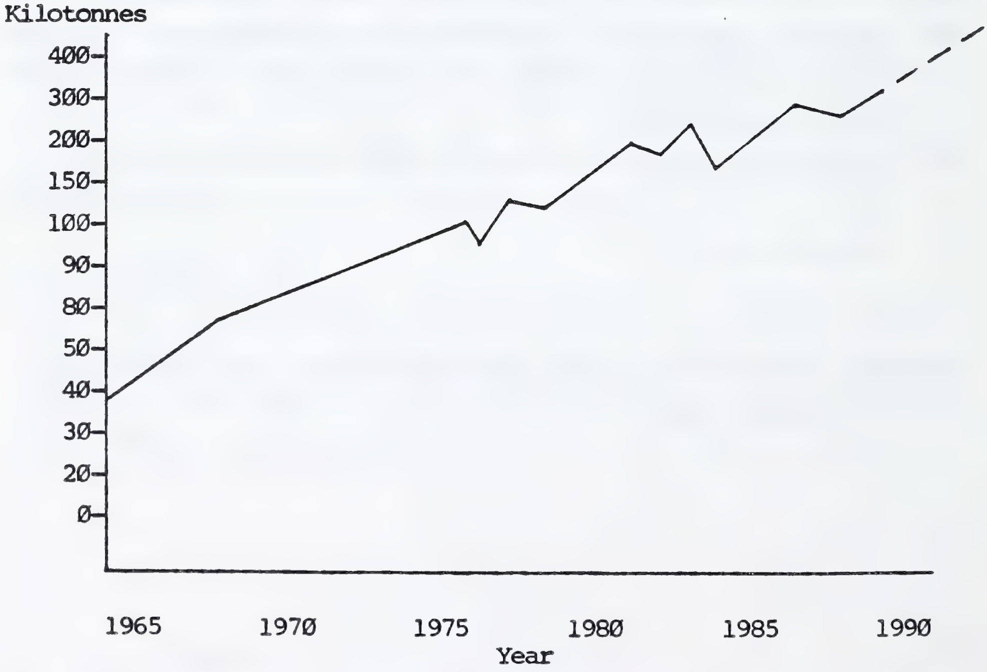
The following describes the market demand for PVC building products in general and also for specific PVC building materials.

3.1 General Market Assessment

Total domestic PVC consumption is increasing. The increase is forecast to go from 230 kilotonnes in 1984 to over 300 kilotonnes in 1990. This estimated growth rate of five percent is illustrated in Figure 3.1. The graph demonstrates that over a twenty year period, from 1965 to 1985, Canadian PVC domestic consumption has increased from 35 kilotonnes to 235 kilotonnes, an increase of close to 700 percent or an average annual increase of approximately 10 percent.

Figure 3.1

Canadian PVC Domestic Consumption



Source: Esso Chemical Company

The historical increase has been much larger than forecast, because it was a new product, innovative developments were occuring with the product, and it was gaining market acceptance. The five percent forecast annual growth rate represents a good increase in demand. This will come about through continued growing confidence in the products, innovative developments and more relaxation of building codes with respect to PVC.

The markets for PVC building products are largely determined by the level of residential building activity, innovative developments with new and existing PVC products, and by their acceptance in the market. Table 3.1 shows the value of various products used in residential construction in Alberta in 1984. With increased levels of residential construction activity, these values could be considerably larger.

Table 3.1

Total Value by Types of Building
Products for Residential Construction

Alberta 1984

Product	Value ($000)
Roofing	6,604
Windows	4,482
Exterior Finish	7,505
Flooring	6,889
Plumbing	8,706
Heat/Ventilation	8,308

Source: Alberta Residential Building Products Study, 1985.

Table 3.2 demonstrates the volatile nature of construction activity and the market potential for construction material if activity were to increase to pre-recession levels.

Table 3.2

Building Permits Issued

Alberta 1975 - 1985

Year	Total
1975	29,614
1980	35,306
1981	50,531
1982	22,380
1983	14,528
1984	7,443
1985	9,534

Source: Statistics Canada, Catalogue No. 64-001

While the markets for vinyl products, if manufactured in Alberta, are largely dependent on the Alberta markets, extra-provincial markets also present good potential. This will be discussed and assessed more thoroughly in the following sections.

The markets and degree of competition for an Alberta producer will also vary for each of the potential PVC building product types. Each are analyzed separately in the sections which follow.

3.2 Residential Renovation Activity

Residential renovation has increased considerably as an important part of total residential construction activity in Canada over the past decade. Total estimated residential renovation expenditures in Canada have exceeded expenditures on new residential construction since 1982. In 1985, renovation expenditures were $12.6 billion, whereas expenditures on new residential construction were $11.6 billion.[1]

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[1] The Demand From Residential Renovation For Selected Wood Products, Dept. of Regional and Industrial Expansion, Sept. 1986.

Renovation expenditures in Quebec, the Prairies and the Atlantic Regions accounted for around 55 percent of total expenditures on residential construction in 1985. In Ontario and British Columbia, renovation expenditures accounted for about 50 percent of total residential expenditure.[1]

The main types of exterior renovation work undertaken by homeowners are outlined below in Table 3.3. The table presents the proportion of renovating homeowners who undertook each of the types of work, and the average expenditure by those who undertook such work. About one-third of these renovation jobs were entirely do it yourself.

Table 3.3

Most Common Types of Exterior Renovation Work in Last 12 Months

Canada, 1985

Renovation	Percent of Renovators Undertaking Work	Average Expenditure (Dollars)
Exterior Painting	19	315
Landscaping	16	780
Roofing	11	1,505
New Windows	9	1,620
Fencing	8	775
New Doors	7	735
Driveway/Walkway Paving	7	975
Verandah/Porch/Sundeck	7	1,105
Siding or Walls	6	2,800
Eavestrough/Soffit	6	725
Patio	4	805
Weatherstripping	3	55
Entrance Steps	3	535
Chimney	2	530
Garage	2	2,970
Addition of Room	2	20,385
Pool/Hot Tub	1	6,365
Other	2	1,750

Source: The Demand for Residential Renovation for Selected Wood Products, Department of Regional and Industrial Expansion, Sept. 1986.

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[1] The Demand From Residential Renovation For Selected Wood Products, Dept. of Regional and Industrial Expansion, Sept. 1986.

Almost all homeowners undertake some renovation work each year. However, both the incidence of renovation activity and the average amount spent on renovation jobs tend to rise with household income and with the value of the dwelling.

In the previous sections a variety of potential PVC building products were identified and discussed. Several are relatively new products with innovations occurring at a relatively rapid rate. The markets for several are also currently fairly limited although with the advent of plastics the market potential is in many cases quite good.

This study focuses on three PVC residential building products: pipe, siding and windows. The reason three were selected is that it is beyond the scope of this research to do market and production assessments for each potential product. These three represent some of the more established of the products with relatively larger current market shares.

3.3 Pipe

Discussions with local producers have indicated that pipe is by far the biggest use for PVC resin. Approximately 80 percent of Alberta PVC resin production goes into PVC pipe, another 15 percent goes to siding and 5 percent goes into window framing and smaller uses.[1]

In the past five years, a tremendous decrease in the number of pipe manufacturers has occurred as larger manufacturers have taken over the smaller manufacturers. This has created an oligopolistic industry which makes entry into the PVC pipe industry very difficult.

There are two main plastic pipe manufacturers in Alberta. The two companies are Canron and Sceptor. They both capitalize on economies of scale, good technology, a low value for the Canadian dollar and an aggressive market expansion approach.

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[1] Most of the data in this section was obtained through personal interviews with Esso Chemical Company and the Vinyl Council of Canada.

Acrylonitrile-butadiene-styrene(ABS) dominates the drain, waste and vent pipe sector, despite a price disadvantage. This is due to the greater marketing focus on Alberta by ABS producers and the fact that ABS was on the market before PVC. In terms of cost, PVC is lower priced and its durability is comparable. Fittings for drain, waste and vent pipe are also dominated by ABS.

Because of its cost advantage, concrete is the most commonly used material in the manufacture of the larger diameter pipes used in construction and municipal pipe markets. However, PVC has still made spectacular penetration into the construction and municipal pipe markets. In the smaller diameters, ductile iron is the main competition for pressure pipe. ABS, asbestos cement, and other materials are the main competition for the sewer pipe.

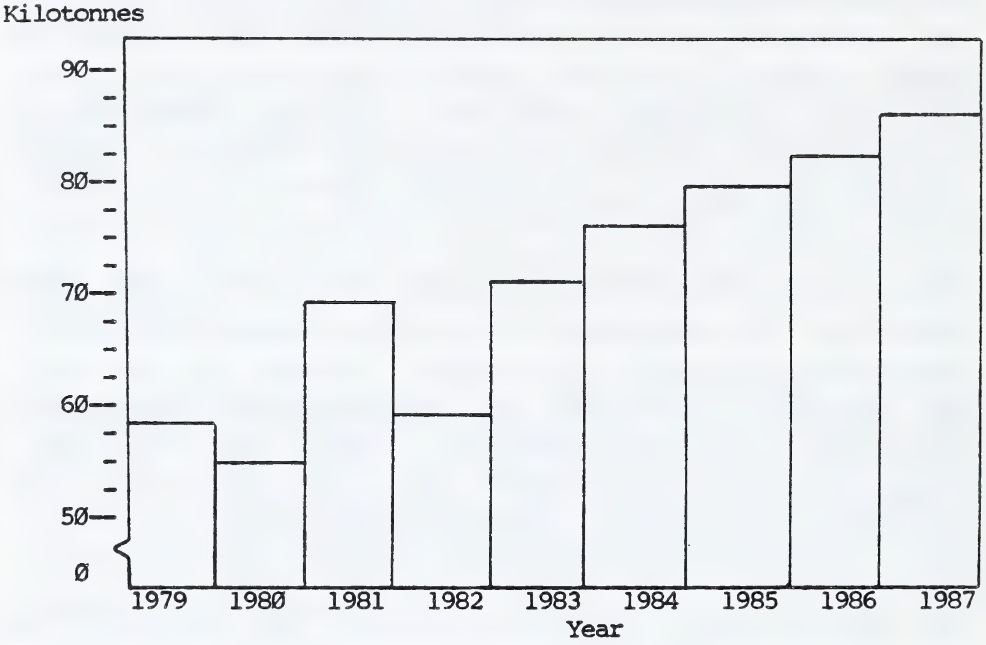
Most pipe is used in new house construction, and commercial and industrial construction. The repair and renovation market is small, but is expected to grow as PVC pipe replaces the older metal pipe. Figure 3.2 demonstrates the large increase in domestic PVC resin consumption for pipes and fittings from 1979 to 1987. The increase has been from 58 kilotonnes in 1979 to 85 kilotonnes in 1987, an average annual increase of close to 5 percent. There are various types of pipe which have unique market characteristics. These are addressed individually below:

i) Watermain Pipe

PVC watermain pipe and fittings are a maturing market. Between 1976 and 1983, resin consumption in that sector increased at an annual rate of 10.8 percent. However, the rate of growth has decreased significantly in recent years. Since 1979, the average annual growth rate has been just under 5 percent. This rate should continue, as a minimum, in the foreseeable future.

Figure 3.2

Canadian PVC Resin Consumption for Pipe and Fittings



Source: Esso Chemical Company

PVC pipe has a 55 percent share of the market, on a footage basis, for watermain pipe 12" or less in diameter. By contrast, it has only a five percent share of the 14" to 24" market. This is demonstrated in Table 3.4 which shows market share for various watermain pipe materials.

Table 3.4

Canadian Watermain Pipe Markets
(Percent of Market Share)

Watermain	Polyvinyl Chloride	Ductile Iron	Asbestos Cement	Steel	Concrete	Poly-ethylene
up to 12"	55	43	1	1	—	—
14" to 24"	5	24	1	8	57	5

Source: Esso Chemical Company

ii) Sewer Pipe

PVC has an estimated 75% share of the sewer pipe market in the 4" to 6" range and 65% of the 8" to 12" market. It is also beginning to penetrate the market for large diameter pipe.

PVC is not as cost-competitive as alternative materials in the large diameter markets. However, it is non-corrosive, easier to install, lighter in weight, and has better joint integrity than competing pipe. These advantages should provide some real growth opportunities over time. PVC's market share is demonstrated in Table 3.5.

Table 3.5
Canadian Sewer Pipe Markets
(Percent of Market Share)

Sewer	Polyvinyl Chloride	Ductile Iron	Asbestos Cement	Concrete	Poly-Ethylene	ABS	Vinyl Chloride
4" and 6"	75	—	5	—	—	10	10
8" to 12"	65	—	10	15	2	—	8
14" to 36"	10	6	10	49	20	—	5

Source: Esso Chemical Company

iii) Plastic Drain, Waste and Vent (DWV)

Another area of market opportunity is drain, waste, and vent pipe. PVC has captured a sizeable share of this market in the United States, from 61 percent in 1978 to 81 percent last year. By contrast, PVC in Canada has a negligible portion (1%) of the DWV market. The market is estimated to be 29 million feet of three-inch equivalent. PVC is more than cost competitive compared to the traditional material, ABS, which is used.

The small market share in Canada, relative to the U.S., suggests that there is considerable room for growth in this market in Canada.

In addition to the above described domestic market potential for PVC pipe, there is also an export potential to the U.S. Since 1978, Canadian imports of PVC pipe and tubing have doubled to 800 tonnes. Canadian exports on the other hand have grown an impressive six fold to 900 tonnes. We are now a net exporter of PVC pipe to the U.S. This trend should continue, particularly to the northern states. Given Canada's relative abundance of petroleum resources, it is logical to assume that we enjoy some degree of comparative advantage over the U.S. for the manufacture of PVC building products.

Exports to the U.S. are also made easier by the exchange rate difference. As long as the U.S. dollar remains at a premium over the Canadian dollar, the price Americans pay for Canadian PVC products is relatively lower than it would be at a high dollar rate of exchange. Fluctuations in exchange rates can significantly affect trade. As long as the value of the Canadian dollar relative to the U.S. dollar remains low, the U.S. market for Canadian products, including PVC are easier to access.

In addition to the U.S. export market for PVC building products, Canada exports overseas and, in particular, to Pacific Rim countries. These are limited markets but should continue to exist and there may be room for expansion with more marketing efforts and availability of supply.

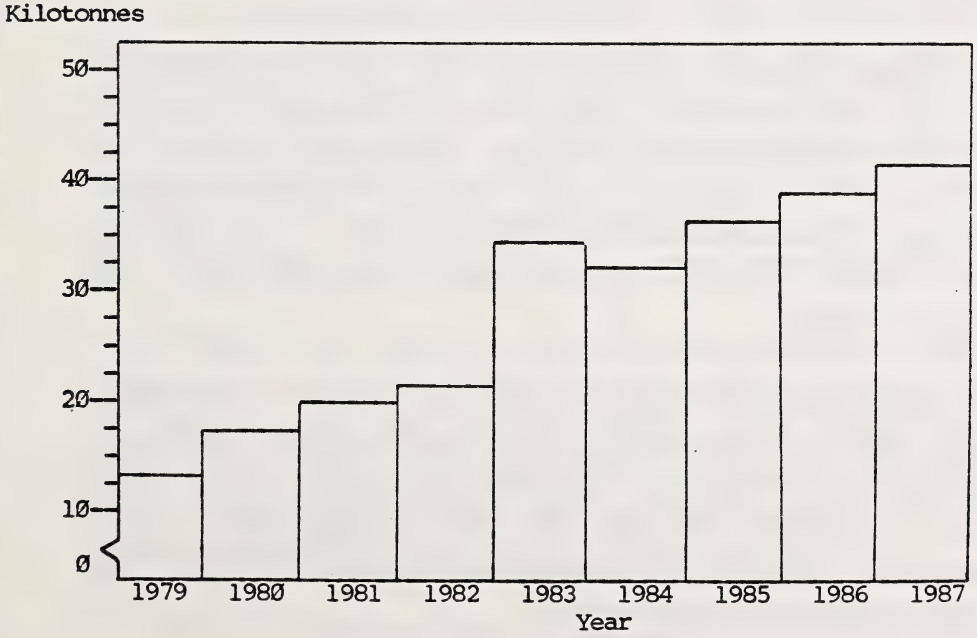
3.4 Siding

Currently there are no companies producing siding in Alberta. All the big producers of siding are in Eastern Canada and B.C. Royal Plastics in Ontario, and Sauder in B.C. are among the major companies that dominate the siding market.

The outlook for vinyl siding is similar to that of pipe. The siding market is maturing. Total consumption of PVC siding has increased and its market share has also increased from 21 percent five years ago, to 44 percent now. As well, the increase in renovation activities within Canada indicates potential for increased PVC siding usage. Figure 3.3 shows the increases in Canadian PVC resin consumption for siding.

Alberta does not have a large population base. Thus, an Alberta siding manufacturer would have to expand into markets outside of Alberta. Expansion into the U.S. is one option due to a low Canadian dollar and a large population in the U.S. Western Canadian markets other than B.C., Saskatchewan in particular, also have some market potential. The N.W.T. and the Yukon are also potential markets due to their proximity relative to other manufacturers, and the relative scarcity of dimensional lumber in the far north.

Figure 3.3
Canadian PVC Resin Consumption for Siding



Source: Esso Chemical Company

Because it is cheaper to ship bulk products than finished products, Ontario producers are located close to their market and do not face the high freight costs that Alberta producers would face for accessing the same market. It is cheaper to send the raw resin down east in bulk hopper cars, than to produce the PVC products in Alberta and ship the finished products to eastern Canada. The main problem for an Alberta siding producer, would be to find sufficient markets for the production to be economically viable. The Alberta market is small and the Ontario and B.C. markets are currently being served by their own local producers. The U.S. market and the Prairie Provinces are the main target areas to consider.

Vinyl penetration of the siding market in Canada has been three times greater than in the U.S. This may be due to a relative scarcity of vinyl in the U.S., since it is produced from an abundant stock of oil and gas which Canada has, and to relatively lower priced alternatives. This would suggest that there may be considerable room for market expansion of this product into the U.S., particularly the northern states.

The proximity to Alberta resin sources is not of great advantage to PVC resin users, because raw resin has to be compounded before it can be used by manufacturers. The main compounding facilities rely on additives from eastern Canada. Calgary's Carlew compounding facilities rely on additives from eastern Canada. This makes the cost of their compounded resin the same as compounds coming from the Eastern plants.

Most siding producers compound their own resin. The initial capital costs of compounding the PVC resin are higher than buying compounded resin. The main advantage of having a raw resin plant located in Alberta would be for the self-compounding siding manufacturer, since little transportation cost would be added from the resin plant to the manufacturer.

3.5 Windows

The window market suppliers in Alberta consist of local window fabricators, one PVC extruder, and distributors from eastern Canada. Large vinyl window manufacturers, such as Rehau, are located in Winnipeg. The largest producer of window frames in Canada is Royal Plastiks of Quebec. This is a highly competitive market.

Alberta's only window frame extruder is Engineered Profiles in Calgary, Alberta. Its existence shows that such an operation is feasible in Alberta. A major obstacle to window extrusion is the high capital cost involved.

Windows for new house construction are most frequently made from aluminum, followed by wood and then by vinyl. Market share data is presented in Figure 3.4.

Vinyl windows are currently the least commonly used because they are more expensive than both wood and aluminum windows and because they are relatively new on the market. This is changing as more people are preferring vinyl to aluminum or wood window frames. In 1985, windows comprised nine percent of exterior renovation expenditures (Table 3.3). Industry sources indicate PVC windows comprise approximately five percent of the window market. This is expected to increase as renovation expenditures increase, and as PVC windows become more recognized as the more superior product.

Vinyl windows have already captured a range of nine to 40 percent (depending on the State) of the U.S. residential renovation market [1] compared with less than one percent of the market in new construction. This could suggest that the strength of the U.S. market should provide some excellent export opportunities. That market is estimated to be 50 million windows annually.

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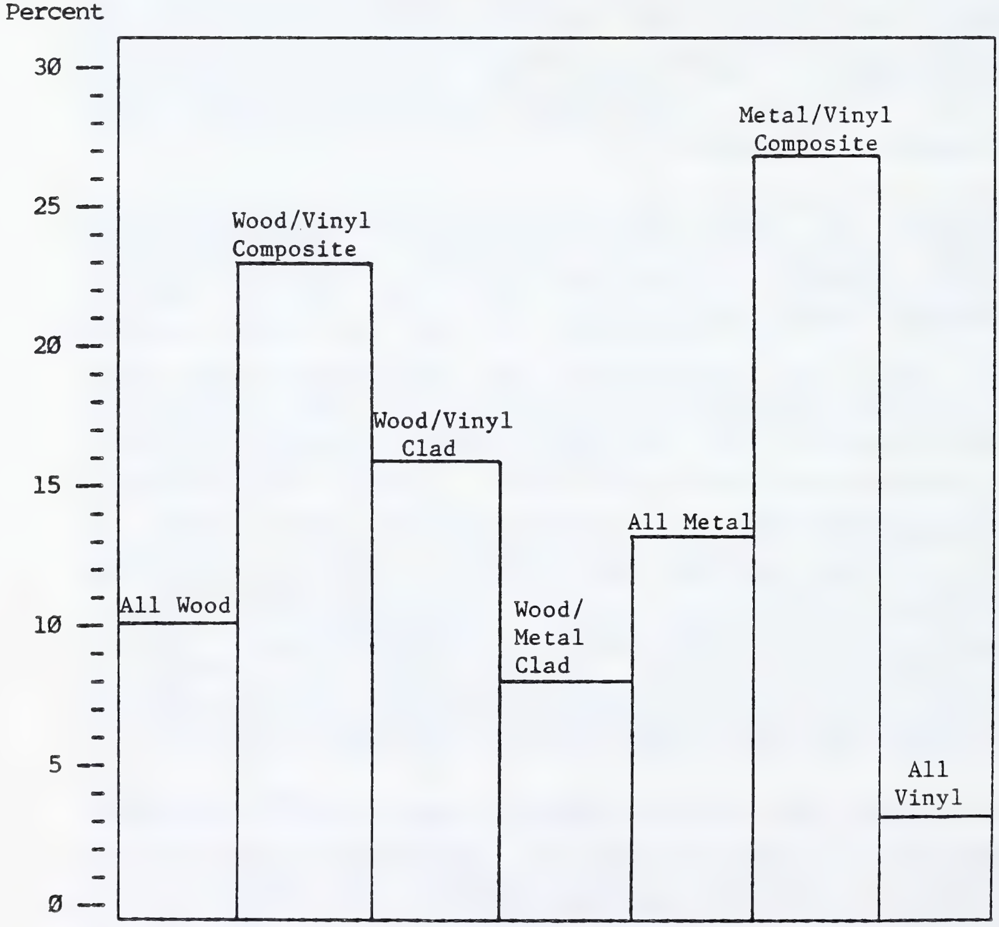
[1] Review of the Canadian Wood Window and Door Industry", Forest Products Directorate, Resource Processing Industries Branch, D.R.I.E. 1986.

With the changing market recognition, windows represent one of the most promising markets for vinyl. This is in the form of both solid vinyl and vinyl clad windows.

Figure 3.4

PVC Market Share
Canadian Window Market (1983)



Source: Esso Chemical Company

4.0 ANALYSIS OF COMPETITION

When assessing the market competition for PVC products, there are two major considerations: one is the current competition from PVC building product manufacturers, the other is competition from substitute products. These are discussed in more detail below.

4.1 Existing Manufacturers

The set-up costs for manufacturing of PVC building materials are relatively high. For this reason, the manufacturers that exist tend to be fairly large. They produce large volumes of product, thereby realizing economies of scale, and serve large market areas. Since each of the PVC products serve different markets, they are addressed separately below.

4.1.1 PVC Pipe Manufacturers

The following table presents a list of PVC pipe manufacturers.

Table 4.1

Canadian Plastic Pipe Manufacturers

Company	Location(s)
AC Impact Industries Ltd.	Montreal, Que.
Canplas Industries Ltd.	Barrie, Ont. & Vanc., B.C.
Canron Inc.	B.C., Alta., Ont., Sask., Que.
Daymond Ltd.	Mississauga, Ont.
Emco Plastics Ltd.	Brampton, Ont.
Flex-Lox Industries	Abbotsford, B.C.
Multi-Fittings Ltd.	London, Ont.
Quality Plastics	Oakville, Ont.
Rehau Plastics of Canada	Montreal, Que.
Sceptor Manufacturing Co.	Ont., Alta., Que.

There are two manufacturers in Alberta: Canron Inc. and Sceptor Manufacturing. Sceptor manufactures PVC pipe while Canron primarily manufactures ABS pipe. Both manufacture relatively small diameter pipe, meet most of the Alberta residential construction requirements and also export out of province.

The other Canadian producers are mostly in Eastern Canada serving the larger eastern markets.

4.1.2 PVC Siding Manufacturers

Table 4.2 presents a list of Canadian PVC siding manufacturers.

Table 4.2

Canadian Producers of PVC Siding

Company	Location(s)
Building Products Canada	Acton, Ont.
Daymond Ltd.	Mississauga, Ont.
Duchesne & Fils Ltd.	Yamachiche, Que.
Flex-Lox Industries Ltd.	Abbotsford, Que.
GSW Building Products Ltd.	Barrie, Ont.
Mastic Inc.	London, Ont.
Mitten Vinyl Inc.	Cambridge, Ont.
Plastmo Ltd.	Brampton, Ont.
Sauder Industries Ltd.	Vancouver, B.C.
Vycan Building Products	Mississauga, Ont.
Vytech Vinyl Inc.	Maple, Ont.

Similar to pipe manufacturers, these tend to be relatively large operations. There are no PVC siding manufacturers in Alberta. The only one in western Canada is in B.C. The others are all located in the proximity of the relatively larger eastern markets.

4.1.3 PVC Window Extruders

Table 4.3 presents a list of Canadian PVC window extruders and fabricators.

Table 4.3

Canadian Extruders and/or Fabricators of PVC Windows

Company	Locations(s)
A.C. impact Plastics	Montreal, Que.
Canada Wood Tape	Brampton, Ont.
Canplast of Canada	Montreal, Que.
Celco Plastics Ltd.	Coquitlam, B.C.
Canadian Gypsum Ltd.	Toronto, Ont.
Dashwood Industries Ltd.	Centralia, Ont.
Daymond Ltd.	Mississauga, Ont.
Dominion Plastics Ltd.	Toronto, Ont.
Duratech Ltd.	Winnipeg, Man.
Ener-Savr Vinyl Products	Edmonton, Alta.
Engineered Profiles Ltd.	Calg., Alta, Winnipeg, Man.
Extrusion Plastics	Markham, Ont.
Extrusion Vinyl & Plastics	Laval, Que.
Flex-Lox Industries	Langley, B.C.
Furlong Plastics	Toronto, Ont.
GSW Building Products Ltd.	Barrie, Ont.
Ginn Bros.,	Verdun, Que.
Gravehurst Plastics Ltd.	Gravenhurst, Ont.
Homeshield Industries Ltd.	Brampton, Ont.
Industrial Plastic Extrus	St. Hubert, Que.
JT Plastics	Winnipeg, Man.
Kildonan Plastics	Winnipeg, Man.
Mactac Canada	Brampton, Ont.
Magna Plastics	Surrey, B.C.
P.H. Tech. Inc.	Levis, Que.
Pillar Plastics Ltd.	Toronto, Ont.
Plastibec	Boisbriand, Que.

Continued ...

Table 4.3
Canadian Extruders of PVC Windows (Continued)

Company	Locations(s)
Plasticshaw Ltd.	Shawnigan, Que.
Poly-Chlor Plastic Ind.	Coquitlam, B.C.
Poly-Tec Innovations	Langley, B.C.
Preciform Inc.	Chomedy, Que.
Precision Plastics Ltd.	Edmonton, Alta.
Progress Plastics Ltd.	Winnipeg, Man.
Quality Plastics	Oakville, Ont.
R & M Plastics	Toronto, Ont.
Rehau Plastics	Prescott, Ont.
Royal Plastics Ltd.	Toronto, Ont.
Sauder Industries Ltd.	Vancouver, B.C.
United Plastics Components	Exeter, Ont.
Vycan Building Products	Mississauga, Ont.
Western Profiles Ltd.	Wpg., Man., Calg., Alta.
Yorkview Plastics Ltd.	Concord, Man.

This listing is considerably larger than for the PVC pipe and siding manufacturers. This suggests that considerable fabricating is done in smaller scale plants. Out of this large list, four are in Alberta and most of the others are in eastern Canada. Only one of the four extrude. The Alberta extruder and fabricators serve the local Alberta market and, as well, export out of province.

4.1.4 Summary

The above information on the location of PVC plants suggests that the Alberta PVC market is currently being well served by Alberta manufacturers for pipe and extruded windows. The exception with pipe, however, is that the larger diameter pipe is not being produced in Alberta. There is currently no Alberta based PVC siding manufacturer.

4.2 Substitute Products for PVC

PVC is a relatively new building product that has evolved with the advent of the petro-chemical industry. Therefore, in the last 15-20 years, it has been increasing its market share through awareness and availability. As with any new product, its major competition has come from the established materials. Table 4.4 presents a listing of substitute building materials for PVC for each of the three major product types. It also presents a statement of the current price relative to PVC.

Table 4.4

PVC Product Substitute
Materials and Relative Price Ranking

Product	Price
Pipe	
. ABS	Higher
. Concrete	Lower
. Ductile Iron	Higher
Siding	
. Brick	Higher
. Aluminum	Higher
. Wood	Varies
Windows	
. Aluminum	Lower
. Wood	Varies
. Steel	Varies

With the exception of ABS for pipe, the other materials have been available for a relatively long period of time.

ABS is a more complex linear thermoplastic. Its chief uses in construction are for pipe, molded panels, imitation wood moldings, and sheet material. In Alberta, ABS is the most common plastic chosen for residential pipe. This is due to the focus on the

Alberta market by ABS manufacturers and distributors. In many other provinces the reverse is true, with PVC being the leading plastic pipe. In commercial and industrial uses in Alberta, PVC is the dominant pipe. An obstacle to PVC entry into residential pipe is the reluctance of suppliers to carry double lines of inventory with both PVC and ABS lines.

Aluminum and its alloys are about one-third the weight of steel. This light weight is one of the chief advantages of aluminum for construction. Besides its light weight, aluminum is protected from corrosion by a thin film of its own oxide, alumina. Like steel, this metal is available in a range of alloys that provide a range of properties. However, it has two significant disadvantages: a high co-efficient of thermal expansion (twice that of steel); and a modulus of elasticity one-third that of steel. This lesser stiffness must be allowed for in design so that if aluminum is substituted for steel, the aluminum sections will be somewhat larger than for steel. Aluminum shapes are extruded from small round billets through extrusion dies. Extrusion dies are relatively inexpensive, and therefore it is often economical to design a special aluminum shape for structural or trim purposes.

The other listed materials are more traditional and do not require elaboration. As PVC evolves, and more innovative developments occur with the resin as a building material, new superior product characteristics will emerge and the price will drop relative to other materials. This should serve to increase its market share.

5.0 MARKET CONSIDERATIONS

An analysis of PVC building product markets is very complex. Some of the characteristics which make the market analysis complex are the relatively large size of most of the manufacturers; the relatively small number of manufacturers, which results in oligopolistic market characteristics; the large market areas that are served; the need to compound the original PVC resin; and the pricing structure for PVC resin which is as complex as the pricing mechanisms for other petroleum products.

Because it is a new industry, there is not a great deal of information available. The information which can be obtained tends to be very limited. Most plastic manufacturers are very secretive about their markets and their operation. This makes any sort of forecasting very difficult.

The following provides scenarios depicting the potential demand and production of new entrant(s) into the PVC siding and window markets. The projections are based on market information, current market trends, and transportation cost advantages.

As previously indicated, the PVC pipe market in Alberta is dominated by a few large producers. The possibilities of entering the PVC pipe industry are not discussed due to the high barriers of entry to this industry. The oligopolistic nature of the industry, along with the economies of scale would require large capital outlays, and expertise, rendering this venture difficult for a new entrant.

5.1 PVC Siding Market

5.1.1 PVC Siding for the New Construction Market

A 1980 study by the Vinyl Council of Canada, indicated that the PVC siding market in Canada comprises 25 percent of the total Canadian siding market for low rise residential housing. Table 5.1 is based on the number of new housing starts in Alberta from July 1986 to June 1987 (8,124)[1]. Twenty-five percent was taken to represent the number of new dwelling units using PVC siding (2,031). Most new houses now are built with siding and virtually all have siding on at least the front. That number was then multiplied by the average number of pounds of siding required (900 lbs.)[2] to arrive at an estimated amount of PVC siding required. An annual increase of five percent per year is assumed. This is based on the U.S. average annual increase of seven percent. Because there currently does not exist a PVC siding extruder in Alberta, market penetration rates of 33 percent for year one, 50 percent for year two, and 75 percent for years three to five are assumed.

Table 5.1

Potential Demand for PVC Siding in the Alberta New Housing Market

	000 lbs.	
	All of Alberta	New Entrant
Year 1	1,889	603
Year 2	1,919	960
Year 3	2,015	1,511
Year 4	2,116	1,587
Year 5	2,222	1,666

5.1.2 PVC Siding for the Renovation Market

There is no data available that specifically identifies the demand for PVC siding used for home renovations. A variety of sources must be used to estimate the possible market for this product applied to home renovations.It is estimated that 25 percent of siding for new homes, and 75 percent of siding for home renovations is PVC siding.[3]

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1. Canada Mortgage Housing Corporation, Alberta. (The forecasts based on this value are conservative, since some projections put new housing starts over the next few years at considerably higher levels.)
2. Source: Vinyl Council of Canada, 1980.
3. Industry Sources.

In order to estimate the market demand for this product in Alberta it is necessary to first identify the extent of the renovation market. The following estimates are based on data found in a document on residential repair and renovation in Alberta.[1]

The study found that 44 percent of Calgary and Edmonton homeowners had done work on the exterior of their homes in the 12 month period prior to the survey, and that four percent of homeowners who undertook exterior work renovated siding or walls. This renovation excludes painting. Therefore four percent of 44 percent of all homeowners (1.76 percent) in Calgary and Edmonton did siding and walls renovation work.

The same percentage is assumed to apply to all Alberta homeowners. This being the case 1.76 percent of the total stock of housing in Alberta has major exterior work done on siding and walls every year in Alberta.

If we assume that 75 percent of these involve the addition or changing of siding on a house, then 1.32 percent of homeowners add or replace siding on their homes every year. Given that PVC siding has 75 percent of the home renovation market, PVC siding is used on one percent of the existing stock of all homes every year in Alberta.

The total detached housing stock in Alberta is approximately 546,000 units. Therefore approximately, 5,460 single family homes add new PVC siding every year, in Alberta.

At an average of 900 lbs. of siding per home, the current market for PVC siding for house renovation in Alberta is 4,914,000 lbs. of siding annually.

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[1] Clayton Research, Residential Repair and Renovation in Alberta, Alberta Department of Housing, February 1986.

The following table was constructed assuming a five percent increase in production per year. This is based on the seven percent growth rate in the U.S. market[1]. As well, because there are no PVC siding manufacturers currently in Alberta, it is assumed that a 33 percent market share will be secured in year 1, 50 percent in year 2, and 75 percent in years 3 to 5.

Table 5.2

Potential Demand for PVC Siding in the Alberta Renovation Market (000 lbs.)

	All of Alberta	New Entrant
Year 1	4,914	1,622
Year 2	5,160	2,580
Year 3	5,418	4,064
Year 4	5,689	4,267
Year 5	5,973	4,480

5.1.3 Total Alberta PVC Siding Market

The combined potential demand for a new entrant to the PVC siding market in Alberta is shown in Table 5.3.

Table 5.3

Total Potential Demand for PVC Siding in Alberta for New Entrant (000 lbs.)

	Year 1	Year 2	Year 3	Year 4	Year 5
Renovation	1,622	2,580	4,064	4,267	4,480
New Construction	603	960	1,511	1,587	1,666
	2,225	3,540	5,575	5,854	6,146

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[1] Modern Plastics, July 1987 edition.

5.1.4 Export Market Potential

Due to Alberta's proximity to the Northern Tier States, Alberta would have a transportation advantage over the B.C. PVC siding extruder. A recent report in Modern Plastics (July 1987 edition) indicated that "Canadian vinyl siding producers are increasingly affecting the U.S. market", and one company reported that at least 80 percent of its output is oriented to U.S. markets. Table 5.4 was constructed assuming that a PVC siding extruder in Edmonton could export 10 percent of its total production to the northern states. With good marketing efforts this export percentage could be increased substantially.

Table 5.4

Export Potential to Northern Tier States (000 lbs.)

Year 1	223
Year 2	354
Year 3	558
Year 4	586
Year 5	615

Alberta would also have a transportation cost advantage into North Western Saskatchewan, affecting approximately 40 percent of the population. Table 5.5 assumes a transportation cost advantage over competition located in Winnipeg. The potential PVC siding demand for the Saskatchewan market was based on 4,148 housing starts (August 1986 to August 1987)[1]., from which 40 percent was taken to identify the market size. This is approximately 1,659 units. The PVC siding market comprises approximately 25 percent of the total siding market or approximately 415 units. This is a potential PVC siding market of 373,500 lbs. A five percent growth rate is assumed per year, with market penetration rates of 33 percent for year 1, 50 percent for year 2, and 75 percent for years 3 to 5.

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[1] Canada Mortgage Housing Corporation - Saskatchewan

Table 5.5

Export Potential North Western Saskatchewan - New Housing (000 lbs.)

	Total Potential (40% of Population)	New Entrant
Year 1	374	123
Year 2	392	196
Year 3	412	309
Year 4	432	324
Year 5	454	340

The renovation market for North Western Saskatchewan was estimated by taking a ratio of the total population of Saskatchewan and the total population of Alberta, multiplied by the total potential Alberta renovation PVC siding market. From this 40 percent was taken to identify the market size with a transportation cost advantage.

Table 5.6

Export Potential North Western Saskatchewan - Renovation Market (000 lbs.)

	Total Potential (40% of Population)	New Entrant
Year 1	227	91
Year 2	441	220
Year 3	694	521
Year 4	729	547
Year 5	766	574

5.1.5 Total Market Production

A report put out by Regional, Industrial, Expansion indicates the renovation market to be growing in Alberta, and that residential renovation expenditures more than doubled in the past fifteen years.[1] Siding or walls comprised six percent of the most common types of exterior renovation work in Canada in 1985. New housing starts have also been increasing but not as significantly as the renovation market. Table 5.7 comprises the Production Potential of the various markets for PVC siding to a new entrant in Alberta.

Table 5.7

Total PVC Siding Production Potential - New Entrant (000 lbs.)

	Year 1	Year 2	Year 3	Year 4	Year 5
All Alberta	2,225	3,540	5,575	5,854	6,148
North Western Saskatchewan	214	416	830	871	914
Northern Tier States	223	354	558	585	616
	2,662	4,310	6,963	7,310	7,676

A new entrant into the PVC siding market in Alberta, would have the advantage of being the first PVC siding extruder in Alberta, and thus having no local competition. However, a comprehensive marketing plan and a quality product will be required to meet the strong competition of existing Canadian PVC siding extruders, and to realize the potential PVC production.

5.2 PVC Windows

The PVC window industry in Alberta consists of an extruder located in Calgary, and several PVC window fabricators. All of the extruder plant work is done on a custom order basis. The fabricators put the window together, including glass, screens, etc. The window extruder in Calgary has indicated that there is not a large enough demand for PVC windows to extrude only window frames. They have therefore diversified their extrusion line to include other PVC products.

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[1] "The Demand From Residential Renovation For Selected Wood Based Building Products", Regional Industrial Expansion, September 1986.

5.2.1 PVC Window Forecast

The following scenario outlines the potential demand:

- a recent study by HLA Consultants estimated annual window consumption in Alberta to be 96,000 units in new construction and 190,000 units in renovation for a total of 286,000 units annually.[1]
- industry sources indicate the Alberta PVC window market to be 5% of the total window market, which would make potential PVC window demand 4,800 units in new housing, and 9,500 units in renovation and retrofit. Total potential Alberta PVC window market would be 14,300 units.
- industry sources indicate that approximately 204 units/windows of the average size 4' x 3', can be extruded from a tonne of resin or in other words, each window unit requires 10.8 lbs. of PVC.

Table 5.8

Potential Alberta PVC Window Consumption (000 lbs.)*

Year 1	162
Year 2	170
Year 3	179
Year 4	188
Year 5	197

* These forecasts are conservative because they are based on new housing starts of 8,124 units (CMHC) over the last 12 months. Some projection suggest starts could exceed this by a significant amount into the 1990's. This would serve to increase the potential demand for PVC building products.

Table 5.8 was constructed assuming a five percent increase in production per year. Because the PVC window market is currently served by several extruders and fabricators (not just from Calgary), the market penetration cannot be as high as for PVC siding. To realize a transportation cost advantage Edmonton will be a desired location. Market penetration rates of 22 percent for year 1, 40 percent for year 2, and 50 percent for years 3 to 5 are used to derive the market potential for a producer.

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[1] HLA Consultants, "Technical and Economic Feasibility for the Production of Densified Aspen Window Framing and Hardwood Flooring", 1987. (p. 66)

A PVC window extruder based in Edmonton would have a transportation cost advantage within the Edmonton market. An approximate transportation cost saving of $1.43/100 lbs. could be realized on transport of PVC window materials from Calgary to Edmonton.[1] As well, Edmonton is closer to northern communities, the N.W.T., the Yukon, and North Western Saskatchewan.

Table 5.9 was constructed assuming that approximately 50 percent of the total Alberta market could be served with a transportation cost advantage over the existing Calgary based extruder.

Table 5.9

Potential PVC Window Market in Northern Alberta (000 lbs.)

	50% Alberta Population in Northern Alberta	New Entrant Penetration
Year 1	81	18
Year 2	85	34
Year 3	90	45
Year 4	94	47
Year 5	99	50

The North Western Saskatchewan market could also be served with a transportation cost advantage. Based on population, Saskatchewan requires approximately 40 percent of the units Alberta would require. An Edmonton based extruder would have a transportation advantage to 40 percent of Saskatchewan's population or a market equal to 16 percent of the Alberta market for renovations.

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[1] Local Transport/Freight Company

Table 5.10 is based on market penetration rates that are half of those assumed for the Alberta market. That is because Saskatchewan is a more distant market and will therefore require more market development.

Table 5.10

Potential Export to North Western Saskatchewan (000 lbs.)

	Total Potential	New Entrant
Year 1	26	3
Year 2	28	6
Year 3	30	8
Year 4	30	8
Year 5	32	8

As noted for PVC siding, the renovation market in Alberta is growing. New windows comprised nine percent of the most common types of exterior renovation work in Canada in 1985 creating a larger market for PVC windows.[1] For potential demand to be realized, a new entrant to the PVC window market must have an excellent marketing plan and a high quality product to compete with existing PVC window extruders and must emphasize the transportation cost advantages.

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[1] D.R.I.E., "The Demand From Residential Renovation For Selected Wood Based Building Products", September 1986.

Table 5.11

Total PVC Window Production - New Entrant (000 lbs.)

	Year 1	Year 2	Year 3	Year 4	Year 5
All Alberta	18	34	45	47	50
North Western Saskatchewan	3	6	8	8	8
	21	40	53	55	58

5.3 Total Market Production

If the potential production for a new entrant in PVC siding and PVC windows were combined, a larger production output could be realized.

Table 5.12 indicates the total potential that a new PVC extruder could realize, if its production runs were diversified to include both siding and windows.

Table 5.12

Combined PVC Siding and PVC Window Production Potential (000 lbs.)

	Year 1	Year 2	Year 3	Year 4	Year 5
PVC Siding	2,662	4,310	6,963	7,310	7,676
PVC Window	21	40	53	55	58
	2,683	4,350	7,016	7,365	7,734

One consideration for a new entrant would be to diversify production. The PVC window extruder in Calgary pointed out that the PVC window market is not large enough to produce only windows. Therefore they have diversified their extrusion line to include other PVC products such as pipe, household items, etc. In fact, they extrude PVC windows on a custom order basis only. A new entrant may want to consider extruding both PVC siding and windows. This would increase their output, and greatly improve their economies of scale, to realize a larger potential market.

Over time, other products previously described could also be added to the product line. Once the basic extruder is in place, the addition of new product lines represents a marginal cost increase.

6.0 THE PVC PRODUCTION PROCESS[1]

6.1 Extrusion

Extrusion is a particularly useful processing technique and the most widely used for converting PVC compounds into commercial products. The extrusion process converts thermoplastics to a required form in a continuous manner. Thermoplastics are materials that are capable of being repeatedly softened and hardened by changes in temperature.

The extrusion process is very versatile. It is used to produce plastic rods, pipes, films and thick sheets. It is also used to coat wires and cables and to produce lengths of plastic with various cross-sections. Extruders are also used to feed blow-moulding machines which produce bottles and other hollow articles.

Between 45 and 50 percent of all PVC products are produced by extrusion. The ability of PVC to accept extensive modification, by being compounded with additional ingredients, permits its use in a wide variety of extruded products. These products range from soft gasketing and films to load-carrying products, such as pressure-rated pipe and architectural shapes, such as house siding.

PVC, like other thermoplastics, originally was extruded in an extension of single-screw rubber extrusion technology. Flexible PVC insulating coating for electrical wire and cable represent one of the earliest commercial applications for extruded PVC. The transition from rubber extrusion to PVC extrusion came about quite easily. Original impetus for this application came from the wartime shortage of rubber in the 1940s.

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[1] Paul Richardson, "Introduction to Extrusion", 1974.

The extruder, in its simplest form, is like a giant mincing machine. It has a barrel, a hopper at one end, and at the other end a die which determines the shape of the material extruded. The die corresponds to the plate with all the small holes in the mincer.

The plastic has to be melted before it can flow through the die and be moulded to its final shape. A screw is needed to move the melted resin to the die through which it is extruded. The design of the screw itself varies according to the actual thermoplastic that is to be extruded. Different screws are needed to extrude, say, nylon and polythene.

All screws have one thing in common: at some point along the screw the depth of thread decreases. This causes a gradual compression of the plastics between the screw and the outer barrel. Any air trapped in the granules delivered by the hopper is removed from the molten mass because it is forced back along the screw, so that the extruded pipe, film, etc., is free from air bubbles. The compression of the molten granules also causes the generation of frictional heat and improves mixing. The barrel is heated at the start of extrusion. In cases where the frictional heat is very great, the heaters can then be switched off. It is often necessary, in fact, to cool the plastic. This is done by making the screw hollow. It can then be cooled with cold water or heated with steam as required. The last stage of the screw is designed to control the flow of the molten plastic so that it is extruded uniformly.

The screw of an extruder is driven by a variable speed motor so that the most suitable speed can be chosen for each material. Screws are removable so that it is not necessary to have a separate extruder for each material to be processed. Extrusion machines sometimes have more than one screw. This design of extruder allows better mixing.

6.2 Plasticization of PVC

A plasticizer is a material that is incorporated into a plastic or an adhesive to increase its workability and its flexibility or distensibility.

There are four main ways in which plasticizers are incorporated into resins such as PVC. The methods are: hot compounding, plastisol coating, dry blending, and solvent casting. The first three methods require an energy input by heating, frequently accompanied by vigorous mixing. In the fourth method, the free energy of the solvent-resin system and the small molecular size of the solvent permit intimate mixing of plasticizer and resin without heating.

Hot compounding involves mixing the plasticizer and resin powder (with stabilizers, fillers, pigments, and lubricants) and fluxing together in an intensive mixer such as a batch-type Banbury mixer or any of several continuous mixers or on a two-roll rubber mill at about 150 to 170 degrees celsius. The exact temperature depends not only on the resin, but also on the plasticizer used. From the Banbury mixer or roll mill, the hot plasticized PVC may go to a calendar, an extruder, or a press to be fabricated into film, sheeting, or massive articles, or it may be pelletized for future conversion to finished goods.

Dry blending involves incorporation of the plasticizer into the PVC particles by stirring at 50 to 110 degrees celsius to yield a dry powder barely distinguishable in outward appearance from the original resin. Times to dry blend under standard conditions are at 88 degrees celsius and some at 80 degrees celsius depending on the equipment used.

Plastisol coating and related techniques require certain PVC resins, or paste resins, designed so that the plasticizer will wet the resin particle at room temperature but only very slowly penetrate and solvate it. These stable, creamy dispersions of resin powders in plasticizers are called plastisols.

Plastisols are used for coating cloth such as tarpaulins, tents, and upholstery, and metal such as house siding and dishwasher liners. Dolls and gloves are "plastisol cast" or "slush molded".

Solvent casting requires the PVC to be dissolved in a suitable solvent such cyclohexanone, tetrahydrofuran, or mixtures of ketones and hydrocarbon, such as 1:2:4 mixture of methyl isobutyl ketone, methyl ethyl ketone, and xylene. The solvent can then be mixed with a plasticizer that will make further adjustments in solventability.

6.3 The Production Process

Almost all PVC building products are made by the extrusion process. It starts with an extruder into which is poured solid plastic pellets. The extruder melts the plastic (resin or polymer) and pumps the melt (molten plastic) through a die hole or the desired shape. It then enters a sizing and cooling trough or rolls where the correct size and shape are developed. Next, the newly formed product enters a puller, which is often a pair of motor-driven, rubber-covered rolls. It is the puller (take-off, haul-off, pull rolls) which pulls the molten resin from the end of the die through the sizer. At the end of the line a cutter does the final handling of the product.

Such a process is called a continuous process. Molten platic is pumped through the extruder and pulled away continuously from the die. When the line is running, the person operating it is primarily an inspector to insure that a satisfactory product is being made. In addition, the operator sees that the extruder hopper is filled with pellets and that the finished product is moved away for storage or shipment. Many extrusion processes operate for days without much attention.

7.0 PRODUCTION REQUIREMENTS

7.1 Production Materials

The major component in manufacturing PVC products is the raw PVC resin pellets. As mentioned previously, these pellets have to be compounded to achieve suitable working properties and specific physical characteristics. This requires purchasing compounded resin, or acquiring self-compounding extrusion equipment. Industry sources indicate that it is more cost effective to have an in-house compounding extruder and purchase compounding materials than it is to purchase compounded resin.

To the compounded resin other additives and fillers are added during melting of the resin, to produce the final physical characteristics of the product (ridgity, flexibility, color, strength, etc.).

7.2 Types of Equipment

The equipment required in a PVC extrusion plant varies slightly from product to product. It is important to note that the following lists should be considered only on the basic items required, as subsequent secondary items may be required or desired by the plant manager.

In an extrusion operation the extruder is the key component. Differences in extruder design and/or quality can produce large variances in operating costs, which even in the first few years of operation can be a multiple of the extruder cost itself. These costs can arise from frequent breakdowns, high installation costs, space requirements, low production runs, higher electricity usage, wastage, etc. Industry sources indicate the way around these extra costs is with in-house compounding extruders. Although the initial cost of the compounding extruder is higher, longer term benefits more than make up for the initial cost.

The compounding capability permits the processor to better match material properties to the exact product application. It also allows the processor to better control material quality, and more easily adjust output to production requirements. One type, twin screw extruders, are self-wiping, and therefore do not require costly shut-downs for cleaning, and offer a high degree of mechanical reliability.

Compounding extruders designed with modular systems allow easy conversion of the entire processing section as required, to accommodate continually changing material requirements. Furthermore, to enter a PVC products industry, better economies of scale and more efficient use of materials, fillers and additives, are essential to enhance the overall processing capabilities, to achieve and maintain a competitive edge.

Only an all-encompassing value analysis can provide a rational basis on which to decide the economic merits of one extruder design over another.

For the purposes of this report, an in-house compounding extruder is used in the capital cost estimates, based on industry indicators of it being the superior system. The price of an extruder can be as high as $600,000. However, for this study an average cost of $300,000 for the extruder is used.

Table 7.1

Siding Plant Equipment

Extruder (3 lines @ $300,000 ea.)	$900,000
Siding Puller (2 @ $22,585 ea.)	45,170
Computer Cleaning Machine	104,000
Peripheral Equipment	200,000
Downstream Equipment	100,000
Compounding line	500,000
Total Equipment	$1,849,170

Source: Industry Representatives

Table 7.2

Window Plant Equipment*

Extruder (3 lines @ $300,000 ea.)	$900,000
Computer Cleaning Machine	104,000
Peripheral Equipment	200,000
2-Point Welder	28,000
Saw	26,000
Dies (18 @ $33,000 ea.)	594,000
Compounding Line	500,000
Total Equipment	$2,352,000

* The number of extrusion lines, equipment requirements, and costs are estimates based on discussions with industry sources, as to the size needed to be competitive with current producers.

7.3 Building Requirements [1]

Plant structures vary significantly between different PVC building products, and among makers of the same building products. The compounding plant can be set up on the ground floor of a conventionally built warehouse. A compounding installation requires comparatively little floor space. A system capable of producing up to 10,000 pounds of compound per hour will fit comfortably into only 10,000 square feet of floor area. Twin-screw compounding extruders occupy less space than their single-screw counterparts, because smaller size units are employed for any given output requirement.

Because a mezzanine is required for pre-blending and gravimetric feed of resin and additives, ceiling heights should be from 16 to 20 feet in the compounding area.

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1. Source: SPE Journal, February 1973 - Vol. 29

Raw materials can be stored in silos, and an overhead rail parallel to the axis of the compounding machine will facilitate screw and die changes. The plant structure should also include restrooms, receiving areas, office space, and parking. Future growth and operation changes should be considered in the plant layout.

7.4 Labour Requirements

The number of staff required to operate a PVC plant depends on its production volume, and specific needs. Estimates on labour costs and requirements are based on discussions with industry sources, and the current market situation.

In the early phases of the business, the plant manager will be involved in the selection of a distributor and development of a marketing plan, which would include an aggressive promotional strategy. The strategy should include advertising, and provision of research information to consumers which stresses PVC's favourable properties for windows and siding. The manager should be responsible for the operation of all phases of the business. His primary objective should be to operate the plant at a profit. The manager should possess the following characteristics:

- chemical engineering background
- experience in PVC extrusion
- experience in running a successful business, and a solid understanding of the PVC window and siding markets and trends
- good management skills, and the ability to get along with people, and motivate them
- experience at selling of products

In addition to a plant manager, the following staff will be required initially:

Labour for combined PVC siding and window plant[1].

- 18 production workers (@ $20,000/yr.) $360,000
- 2 Engineers (@ $36,000/yr.) $72,000
- 1 Draftperson $24,000
- 1 Tool and Die Machinist $27,000
- 1 Maintenance person $22,000
- 1 Plant Manager $50,000

Total annual labour: $ 555,000

The production workers would have various jobs throughout the various stages of the extrusion process, such as monitoring equipment operations, checking for malfunctions and resin levels to maintain quality and optimum operation levels. The production workers could be drawn from the local labour force, but should have some experience in operating technical equipment.

The engineers and draftperson are required to upgrade designs of products, and maintain levels of efficiency throughout the extrusion process. Knowledge of PVC extrusion is a requirement.

The tool and die machinist is required to operate the interchanging of the different dies for windows and siding, and to minimize downtime during changes in extrusion runs.

A general maintenance person is required to ensure efficient day-to-day operations throughout the plant.

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[1] These estimates for the purpose of this report are based on discussions with industry sources and on scale of plant operation.

8.0 LOCATION ANALYSIS

8.1 Location Factors for a PVC Products Manufacturing Plant

- Source of Raw Materials: If the plant is self-compounding, it should be located close to a raw resin source, which would reduce transportation costs and time of delivery. PVC resin is produced by BF Goodrich at Fort Saskatchewan, and compounding supplies can be purchased from plants located in Ontario and Quebec.

- Labour Availability: Supervisory and engineering talent is required for high volume - automated equipment, both of which can likely be recruited from within Alberta. The exact labour requirements will vary considerably due to the differences in the scale and size of various PVC operations.

- Transportation Costs: With the raw PVC resin plant located near Fort Saskatchewan, transportation costs of raw materials will be greatly reduced. Access to a railroad is preferable for the finished product so that volume shipments can be easily accomplished. Approximate rail cost is $2,000/via piggyback. Trucking is another means of transporting goods, and trucking costs can range from $0.055/lb. (from Toronto to Edmonton) to $0.12/lb. (from Edmonton to Toronto).

- Operating Costs: A plant site should be located where fixed operating costs, such as building costs, gas and electricity,can be minimized. There are significant differences in energy costs geographically. While such differences do not constitute a major factor in plant selection site, their potential effect upon finished product costs should be established. Of greater importance, however, is the uninterrupted availability of energy.

  Most plastics plants require fairly large quantities of water for cooling purposes. The cheapest source of cooling water is generally from a well or river. If insufficient well or surface water is available, management must consider the probable need to install a recirculating water system, including a cooling tower or a refrigeration system or both.

- Environmental Considerations: The site selected should be one at which operating a plastics processing plant will not violate any local, provincial, or federal regulations. If the plant is to produce on a round-the-clock basis (as is generally necessary for optimum efficiency), there should be no local ordinances forbidding such operation. Local traffic regulations should not interfere with deliveries and shipments of materials. Zoning regulations, with respect to building and silo height, must be investigated. In some operations, problems may arise due to environmental factors such as dust control, garbage disposal, disposal of cooling water, and noise levels. All these factors must be considered before a plant site is chosen.

  Makers and consumers of plastics must recognize and meet the environmental standards that are involved in producing basic plastic resin, manufacturing plastic products, using such products, and eventually disposing of the material or reusing it. Private individuals, the plastics industry, and the government, all have set standards of pollution control which a plastics plant should consider in its location analysis. The plant should have an adequate waste disposal system.

8.2 Plant Location Alternative

Fort Saskatchewan represents a good plant location for the following reasons:

- Proximity to PVC resin producing plant near Fort Saskatchewan, thus eliminating expensive and elaborate transportation costs.
- Proximity to markets and centralized access to transportation facilities.
- Environmental, sociological and economic objections and considerations have already been experienced in this location with the Diamond Shamrock plant.

- A ready labour force is available without payment of relocation costs, etc.
- Transportation facilities are readily accessible.
- Proximity to energy and electricity.
- Proximity to housing for staff.

Previous community attitude research on Petro Chemical developement in the Fort Saskatchewan area should be quite valuable. The specific location will also depend on further demographic studies and attitude studies to see if any new concerns have arisen in recent years. Due to recent layoffs in Alberta's economy, a plant will probably receive minimal opposition if properly planned.

9.0 COST OF PRODUCTION

9.1 Capital and Operating Cost Estimates

Current market conditions indicate that the most viable PVC manufacturing plant in Alberta would be a combined PVC window and siding plant.

9.1.1 Capital Requirements

The equipment required for a PVC siding and window, extruding plant is listed in Table 9.1. It includes the equipment that is basic to both siding and window extruding, and the equipment that is specific to each type of extrusion as indicated in Tables 7.1 and 7.2. It is important to note that this list should be considered as only a basic initial inventory of items to be included in the plant. Other items may subsequently be required or desired by the plant manager.

As previously mentioned, the equipment requirements were determined through discussions with industry sources. The equipment can be purchased from suppliers in eastern Canada, or from Germany.

Table 9.1

Combined Equipment Costs

Equipment basic to both PVC window and siding extrusion:	
Extruder - 3 lines @ $300,000 ea.	$ 900,000
Computer cleaning mach.	104,000
Peripheral equipment	200,000
Compounding line	500,000
Siding Specific Equipment:	
- Siding Puller - 2 @ $22,585	45,170
- Downstream Equipment	100,000
Window Specific Equipment:	
- 2 point welder	28,000
- saw	26,000
- dies - 18 @ $33,000 each (6/line)	594,000
Total Equipment Cost	$2,497,170

Table 9.2 presents total capital costs required for the establishment of a PVC siding and window extrusion plant. These estimates are based on figures obtained from industry sources.

The proposed plant will require approximately $4,792,820 to start up production, with new equipment purchased for use in the plant.

The amount of materials (resin) required is based on the estimated potential production of a PVC siding/window plant.

Table 9.2

Capital Requirements Window/Siding Plant

Building:		
- 12 mo. lease @ $25,000/mo. (including utilities)		$ 300,000
Combined Equipment Costs		2,497,170
Installation ($50,000/line)		150,000
Pre-operating Expenses:		
- Project Engineering	$ 50,000	
- Start-Up Labour and Materials	100,000	
- Electrical Hook-Up	30,000	180,000
Materials:		
- resin, approx. 1,219 tonnes @ $1.35/kilogram		1,645,650
Contingencies		20,000
Total Capital Requirements		$4,792,820

9.1.2 Potential Annual Operating Costs - PVC Window & Siding Plant

Table 9.3 presents the costs that are projected to occur annually in order to operate the plant. This is based on the assumption that the proposed industry will lease the building space, and purchase new equipment.

Table 9.3

Operating Costs PVC Siding/Window Plant

Operating Costs	Year 1	Year 2	Year 3	Year 4	Year 5
1. Building Lease	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000
2. Equipment	2,597,170	-	-	-	-
3. Materials	1,645,650	2,669,320	4,305,270	4,519,430	4,745,860
4. Accounting and Legal	10,000	5,000	5,000	5,000	5,000
5. Advertising	100,000	75,000	75,000	75,000	75,000
6. Travel Expenses	5,000	5,000	5,000	5,000	5,000
7. Contingencies	20,000	20,000	20,000	20,000	20,000
8. Labour	555,000	583,000	612,000	643,000	675,000
9. Installation	150,000	-	-	-	-
10. Pre-Operating	180,000	-	-	-	-
11. Up-Grading Dies (6 @ $33,000 ea.)	-	198,000	-	198,000	-
Total	$5,562,720	$3,855,320	$5,322,270	$5,765,430	$5,825,860

The following points help to further explain Table 9.3.

1. Building Lease: The cost of the building is based on a year to year lease for five years.
2. Equipment: Costs are as indicated in Section 7, for a combined extrusion operation. It is assumed that the equipment is purchased outright.
3. Materials: The price of raw PVC resin increases and decreases along with increases and decreases in oil prices. It is very difficult to estimate the price from year to year, given the current oil price situation in Alberta. Industry sources indicate raw resin to cost $1.30/kilogram, and compounding additives to cost an additional $.05/kilogram. Therefore, the price of materials is held constant at $1.35 per kilogram.
4. Accounting and legal fees are assumed to be initially high at the start-up of the business.
5. Advertising: The advertising expenses are estimated to be approximately five percent of the total operating costs and would include promotions, print advertising, marketing, etc.
6. Travel Expenses are estimated, and include cost of business trips and sales calls.

7. Contingencies are for hidden costs and are estimated to be approximately four percent of total costs.
8. Labour: Actual numbers of labour and technical people may change in a real production factory. For demonstrative purposes, a five percent increase in salaries and additional labour costs are calculated as production increases.
9. Installation costs are based on industry sources which indicate the cost to be $50,000/extrusion line. It is assumed that installation costs are covered in the first year of operation, unless other equipment is purchased later.
10. Up-Grading Dies: Based on industry sources, each extrusion line requires six dies to extrude one complete frame. Dies are generally upgraded every other year as styles and tastes change.

9.1.3 Potential Product Sales

Tables 9.4 and 9.5 present the potential annual sales of PVC windows and siding. The tables are based on the potential output shown in the previous market section. The projected revenue is dependent on the quality of the plant's products, the number and type produced, the effectiveness of its marketing efforts, and the management of the business. Potential sales can only be estimated on the basis of reasonable assumptions.

Table 9.4

Potential Product Sales - PVC Windows

	Approx. No. of Units	Total Sales
Year 1	1,947	$340,725
Year 2	3,709	649,075
Year 3	4,915	860,125
Year 4	5,100	892,500
Year 5	5,378	941,150

The above table is based on:

1. Industry sources indicate that approximately 204 windows of the standard size 4' x 3' can be extruded from a tonne of resin,and sold at an estimated price of $175.00 each.
2. Estimates for the number of units are based on calculations from the previous market section.

Table 9.5

Potential Product Sales - PVC Siding

	Total Output Converted into (000) St. Ft.	Total Sales (000's)
Year 1	5,324	$ 3,833
Year 2	8,620	6,206
Year 3	13,926	10,027
Year 4	14,620	10,526
Year 5	15,352	11,053

The above table is based on:

1. Industry sources indicate cost of PVC siding to be $.72/sq.ft. Total number of square feet were derived by using the industry information of 100 sq.ft. equating to approximately 50 lbs.

Table 9.6 presents the combined potential sales for both PVC siding and windows. By combining the two extrusion lines, more efficient scales of output can be reached, and may avoid the unnecessary build-up of costly inventories.

Table 9.6

Combined Potential Sales PVC Windows and Siding (000's)

	Year 1	Year 2	Year 3	Year 4	Year 5
Window	$ 341	$ 649	$ 860	$ 893	$ 941
Siding	3,833	6,206	10,027	10,526	11,053
Total	$ 4,174	$ 6,855	$ 10,887	$ 11,419	$ 11,994

9.1.4. Cash Flow Projections

Table 9.7 shows the business revenues for a combined PVC window and siding extrusion plant. The table shows that business revenues exceed operating costs in the second year of operation by about three million dollars. Revenue projections are based on potential production output from a previous Section and are intended for demonstrative purposes only.

Table 9.7

PVC Siding and Window Extrusion Cash Flow Projection
(000's Dollars)

	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue	$ 4,174	$ 6,855	$10,887	$11,419	$11,994
Cost	5,563	3,855	5,322	5,765	5,825
Net Total	(1,389)	3,000	5,565	5,654	6,169

Financing costs are excluded from the cost calculations. The net revenue is then exclusive of capital repayment. Installation and pre-operating costs of $150,000 and $180,000 respectively, are included in first year expenses. These were excluded because the financing needs and terms will vary depending on the circumstances of the entrant. With their inclusion, the operation would still show a profit in the second year of operation.

The operation should show a good before tax profit in year two or three, if there are no major bottlenecks with production start-up. Economies of scale are very significant in enhancing the profitability of the venture. This is particularly evident in year three when sales increase substantially due to good market penetration.

9.1.5. Optimum Scale Plant

Optimum scale refers to that level of operation at which profits can be maximized. This includes many considerations such as:

capital availability, product design, economies of scale, competition, transportation of raw materials and products, labour, and prices.

Although it is beyond the scope of this analysis to study in detail the optimum scale of the proposed operation, it is possible to reach some conclusions. The conclusions are reached primarily on the basis of the characteristics of potential competitors. As previously indicated, there are few competitors in western Canada and the information they provided was limited. However, the two that are used for comparative purposes are both well established and did provide a limited amount of information, but not volumes of production.

Both producers, one extruding window profiles and one extruding siding, indicated several things that relate to optimum plant capacity:

- the markets are competitive;
- volume production is very important;
- it is necessary to be very sensitive to competitors prices; and
- use of high volume modern equipment is very important.

In both cases the companies manufacture more than one line; one did 50 percent custom extrusions, the other extruded mouldings and other construction products. In both cases the product lines of concern for this study, window profiles and siding, represented 50 percent or less of total production. One of the producers had a total of approximately 50 staff excluding all office personnel and the other had a total of 35 staff.

On a comparative basis, the plant that is proposed in this report is capitalized using new and very modern equipment with a capacity to extrude several lines. The suggested initial plant personnel are in the neighborhood of 25 to 30. Since other product lines are produced by the two compared operations, only a proportion of their staff is devoted to siding and window profiles. The proposed plant size will compare favorably in size with the other two operations for the two products under consideration. Given that, plus the use of new modern equipment, this plant would be at a scale sufficently large to realize the same economics of scale as the competition and should therefore be price competitive.

9.1.6 Pricing

Producers of PVC building products indicated that the important variables involved in pricing decisions are the following:

- cost of competing products (wood, aluminum);
- competitors prices;
- costs of raw materials;
- product differentiation; and
- total costs of production.

The manufacturer prices used in this report of $175 per average window unit and $.72/square foot for vinyl siding are based on the best information that could be obtained for manufacturers' selling prices. It must be noted that there are also price variations for these products that are based on product variations. There are a variety of siding types with respect to design, grain and color. Manufacturers prices will vary for each. Similarly for windows, there are a variety of possible colors and profiles. The more unique and custom oriented the works, the higher the price that can be charged.

Given the large variety of choices, it is difficult to assess competing product prices. Generally, lumber is relatively less expensive than vinyl. It is easier to produce but is not as durable and requires considerable maintenance. Aluminum is on average marginally more expensive than vinyl, is also quite durable and also requires more maintenance than vinyl. Vinyl needs to be marketed on its unique characteristics of design, permanence and being maintenance free. As such, it functions in a different market than wood and aluminum and there should be no need to price compete directly with either.

In general, the costs of raw materials for building products are quite expensive. Industry sources indicate they can range between 45 and 78 percent of total production costs. PVC resin will cost approximately \$1.35/kilogram. For siding this translates to approximately \$.33/square foot. For windows, using an "average" window, it converts to approximately \$7.00/window. Relative to siding, windows need more material and labor inputs.

Vinyl siding is a more difficult product to differentiate than windows. It is therefore more important to price on the basis of competitors prices and needs large volumes to remain price competitive. According to window extruders, it is possible for an individual manufacturer to establish a differentiated product identity, based on design and custom work and thereby obtain some degree of price independence.

The prices used in this study are representative in the industry, are average and will enable a new producer to compete effectively. A new entrant will have to carefully assess total production costs, look at price variation possibilities and negotiate prices with product brokers. It is anticipated prices should settle in the neighborhood of that which has been used for revenue projections in this study.

10.0 MARKETING PVC WINDOWS/SIDING

10.1 PVC Window Marketing

The distribution channels for the PVC siding, window parts and the finished window product is crucial. In the case of PVC windows, the most efficient way to get the proposed products to the end users is to distribute the products directly to the fabricators. The fabricators assemble the windows to specified dimensions and distribute the completed windows to their customers and to other carriers of finished windows (hardware stores, home improvement centres, specialty window stores, etc.). The fabricator assists in physically distributing the products, as well as offering different levels of service such as glass and screen installation.

The marketing effort can be approached through a cost shared program between the PVC window extruder and the fabricator. The PVC window extruder should closely examine the fabricator's distribution systems, market coverage, range of services, promotional programs and costs, prior to selection. However most fabricators, if they have been in business for awhile, should have good markets.

Initial market research should be carried out to identify if there is a specific type of PVC window that is more popular, or if custom made windows are more popular, who the potential buyer is and their location. A good PVC window fabricator should already have most of the required market information, and should be able to recommend target areas and potential buyers.

In summary, the major marketing effort for PVC windows should be aimed at window fabricators. This will be cost effective since they are the users of the products and already have window markets. A secondary effort, in conjunction with fabricators would be to market to end users, builders and home owners. This will create an awareness of the product and thereby increase both market share and market size.

10.2 PVC Siding Marketing

PVC siding can be distributed to wholesale outlets, which in turn supply retail outlets, such as home improvement centres. The wholesale outlet or distributors are often a branch of the extruder plant, and are located in specific regions to best cover the markets. Such is the case with the PVC siding extruder in Richmond, B.C., which has a distributor located in Edmonton. The distributor then supplies local outlets at wholesale prices. The cost of transporting the siding is paid either by the broker or the extruder depending on the terms of delivery.

Advertising and promotion are important in informing the potential buyer on what styles are available, that custom products can be produced, on the range of colors, and on how and where to buy the product. All advertising should mention the specific stores where the product can be bought. A joint effort in distribution, advertising, promotion, and personal selling will help reduce overall costs by reaching the target markets more efficiently. The extruder plant should hire a salesperson, knowledgeable of the plant's capabilities, to represent the plant and its products to fabricators and distributors, especially during the initial start-up.

10.3 General Marketing Considerations

Competitive prices and a good quality product are important marketing considerations. Quality control should be implemented by the extruder, and an on-going process of product evaluation should be used by the fabricator. Delivery procedures, and turn-around on custom made orders are important in obtaining customer satisfaction.

A good marketing strategy will include a variety of promotional activities. They include advertising, direct mail sales promotion, personal selling and publicity. Selecting the relative importance of these activities will depend on the nature of the product, available budget and nature of the customer. The determination of promotional activities which best serve the business, can be derived by taking the following into consideration:

1. Selecting techniques which will reach the target markets most effectively and at the least cost.
2. Determining how much of the marketing budget can be assigned to each technique, and if it is enough to achieve results.
3. Identifying special features of the company that will influence the effectiveness of the activities. Determining whether specialized or mass audience channels should be used and whether promotions should be concentrated at certain times of the day, month or year.
4. Determining what should be said to set the company apart from the competition.

The PVC window and siding market is relatively new, and does have the potential to expand and replace other types of windows being used, such as aluminum and wood. It is important, however, in the promotional strategy, that a great deal of emphasis is placed on promoting the attributes of PVC windows and siding (durability, easy maintenance, slow aging, etc.), which make them superior to other types of products. As well, a PVC siding extruder located in Edmonton would have the advantage being the only siding extruder in Alberta, and could make significant inroads in transportation cost savings. The renovation market in Alberta has been increasing over the past couple of years, and it is an important market for a PVC siding and window extruder to capture. The excellent properties of PVC, especially its slow aging, make it ideal for homeowners who want maintenance free improvements.

11.0 CONCLUSIONS

The PVC building products market for the three main products that were analyzed - pipe, siding and window frames - is a continuously increasing market. Forecasts suggest that demand will grow at an estimated rate of 5 percent per year for some time. Growth forecasts are relatively optimistic for Alberta, Canada and the U.S. The major variables which result in this optimistic forecast are the following:

i) PVC is a relatively new product gaining market awareness and acceptance;

ii) PVC has some highly desirable characteristics relative to conventional building materials;

iii) PVC is continuously evolving with new superior characteristics being developed;

iv) As a building material, the demand for PVC is related to construction starts. In Alberta and Canada, construction has been down during the recessionary period of the last few years. However, construction activity in the East is now proceeding at a rapid pace and is slowly accelerating in the West;

v) Building code restrictions relating to the use of PVC are slowly being relaxed, eg., PVC can be used for electrical conduit;

vi) Significant economies of scale can be realized due to the large plant sizes. This results in competitive product pricing relative to alternative materials and other producers. The scale of plant suggested in this study is competitive.

All of the above suggest that with innovative developments in PVC types and characteristics and with agressive marketing and promotion, PVC markets and market share will continue to increase, possibly substantially.

At present in Alberta, the market for a new PVC building products manufacturer appears to be best for PVC siding and for windows.

The pipe market demand is well met by existing Alberta producers. Large diameter pipe may be an exception for which there is some limited demand.

There are no existing PVC siding manufacturers in the province. PVC siding is an expanding market with room for expansion in the new house construction market. Currently, the best market for PVC siding is the home renovation market. The export potential is good for siding to other western Canadian provinces, to the northern territories and to the northern states.

The PVC window market in Alberta is currently partially satisfied by a Calgary-based producer. An Edmonton area producer would have a comparative advantage for markets in northern Alberta, the northern Territories, northern Saskatchewan and could also possibly develop some export markets.

Any new manufacturer of PVC building products will face barriers to market entry and to setting up for production. The barriers include the following:

i) a need to develop export markets;
ii) heavy competition from a relatively small number of large producers;
iii) a price structure that does not provide the comparative advantage Alberta should have with its abundant feedstocks;
iv) the need to be a relatively large scale operator of the magnitude suggested in this report in order that economies of scale be realized to enable production at a competitive cost and price;
v) the need to buy compounded resin or to set up a self-compounding plant; and,
vi) the relatively high cost associated with setting up a viable operation.

These barriers can be overcome and the financial prospects for a potential new producer are good.

In order to manufacture competitively and operate at a profit, an Alberta-based manufacturer should be located at or near Edmonton. The operation should produce both siding and windows. The plant should have a self-compounding facility and be of a size as presented in this report in order to achieve good economies.

Although there are various methods of producing PVC products for siding and windows, extrusion is a preferred process. It is more cost effective and provides added versatility for design modifications and additions to capacity.

It is possible to establish a self-compounding facility or to buy compounded resin. For a large scale operation, self-compounding is strongly recommended. It is more economical and provides total versatility as to the type of additives used.

A new producer must pay careful attention to price. The industry is competitive and is price sensitive. Prices will vary with costs of production, which in turn are affected by the price of natural gas. A new producer will have to monitor prices from PVC competitors and prices of substitute products.

The markets for PVC windows will be primarily window fabricators. This will mean a limited market, but with relatively significant sales to each. Markets for PVC siding are to builders and to the home renovation market (home improvement centres, hardware stores, etc.)

Marketing and promotion activities should be pursued directly with fabricators, builders and home improvement centres. As well, joint promotion efforts should be pursued with the above mentioned outlets and directed at households to increase demand for PVC building products and the products of the manufacturer specifically.

The market for PVC building products is sensitive and dynamic. Given the large investment required to produce at a significant level, it is recommended that much more detailed market and feasibility analysis be undertaken before an investment decision is made. This is especially important because the markets could change in the interim, as could the production technology. At this level of research, production appears to be quite feasible, but should be verified with more detailed research.

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APPENDIX A

PRODUCERS OF PVC BUILDING PRODUCTS

PRODUCERS OF PVC BUILDING PRODUCTS

Major Producers of PVC Pipe

1. AC Impact Industries Ltd., Montreal, Quebec.
2. Canplas Industries Ltd., Barrie, Ontario, Vancouver, B.C.
3. Canron Inc. (9 locations - B.C., Alta., Ont., Sask., Que.).
4. Daymond Ltd., Mississauga, Ont.
5. Emco Plastics Ltd., Brampton, Ont.
6. Flex-Lox Industries Ltd., Abbotsford, B.C.
7. Multi-Fittings Ltd., London, Ont.
8. Quality Plastics, Oakville, Ont.
9. Rehau Plastics of Canada, Montreal, Que.
10. Sceptor Manufacturing Co., (3 Locations - Ont., Alta., Que.)

Major Producers of PVC Siding

1. Building Products Canada, Acton, Ont.
2. Daymond Ltd., Mississauga, Ont.
3. Duchesne & Fils Ltd., Yamachiche, Que.
4. Flex-Lox Industries Ltd., Abbotsford, Que.
5. GSW Building Products Ltd., Barrie, Ont.
6. Mastic Inc., London, Ont.
7. Mitten Vinyl Inc., Cambridge, Ont.
8. Plastmo Ltd., Brampton, Ont.
9. Sauder Industries Ltd., Vancouver, B.C.
10. Vycan Building Products, Mississauga, Ont.
11. Vytech Vinyl Inc., Maple, Ont.

Major Extruders of PVC Windows

1. A.C. Impact Plastics, Montreal, Que.
2. Canada Wood Tape, Brampton, Ont.
3. Canplast of Canada, Montreal, Que.
4. Celco Plastics Ltd., Coquitlam, B.C.
5. Canadian Gypsum Ltd., Toronto, Ont.
6. Dashwood Industries Ltd., Centralia, Ont.
7. Daymond Ltd., Mississauga, Ont.
8. Dominion Plastics Ltd., Toronto, Ont.

9. Duratech Ltd., Winnipeg, Man.
10. Ener-Savr Vinyl Products, Edmonton, Alta.
11. Engineered Profiles Ltd., (Calgary, Alta, Winnipeg, Man.)
12. Extrusion Plastics, Markham, Ont.
13. Extrusion Vinyl & Plastics, Laval, Que.
14. Flex-Lox Industries, Langley, B.C.
15. Furlong Plastics, Toronto, Ont.
16. GSW Building Products Ltd., Barrie, Ont.
17. Ginn Bros., Verdun, Que.
18. Gravehurst Plastics Ltd., Gravenhurst, Ont.
19. Homeshield Industries Ltd., Brampton, Ont.
20. Industrial Plastic Extrus, St-Hubert, Que.
21. JT Plastics, Winnipeg, Man.
22. Kildonan Plastics, Winnipeg, Man.
23. Mactac Canada, Brampton, Ont.
24. Magna Plastics, Surrey, B.C.
25. P.H. Tech Inc., Levis, Que.
26. Pillar Plastics Ltd., Toronto, Ont.
27. Plastibec, Boisbriand, Que.
28. Plastiques Profex Ltd., Boucherville, Que.
29. Plastishaw Ltd., Shawnigan, Que.
30. Poly-Chlor Plastic Ind., Coquitlam, B.C.
31. Poly-Tec Innovations, Langley, B.C.
32. Preciform Inc., Chomedy, Que.
33. Precision Plastics Ltd., Edmonton, Alta.
34. Progress Plastics Ltd., Winnipeg, Man.
35. Quality Plastics, Oakville, Ont.
36. R & M Plastics, Toronto, Ont.
37. Rehau Plastics, Prescott, Ont.
38. Royal Plastics Ltd., Toronto, Ont.
39. Sauder Industries Ltd., Vancouver, B.C.
40. United Plastics Components, Exeter, Ont.
41. Vycan Building Products, Mississauga, Ont.
42. Western Profiles Ltd., (Winnipeg, Calgary)
43. Yorkview Plastics Ltd., Concord, Ont.

APPENDIX B

IDENTIFICATION OF ALBERTA PRODUCERS OF SIMILAR PRODUCTS

IDENTIFICATION OF ALBERTA PRODUCERS OF SIMILAR PRODUCTS IN ALBERTA

The following are the producers of similar products in Alberta:*

Aluminum Siding

Blackfoot Trailer Ind. Ltd.	Airdrie
Hlady Home Improvements Ltd.	Calgary
Kawneer Company Canada Ltd.	Lethbridge
R & H Mobile Home Service	Spruce Grove

Steel Siding

Westeel	Calgary
Westeel, Div. Jannock Ltd.	Edmonton

Metal Siding

Gienow Building Products	Calgary
Grant Metal Products	Calgary
Metals West	Edmonton
Proclad Enterprises Ltd.	St. Albert
Westland Metals Div. O	Edmonton

Aluminum Window Frames

A Fluet & Sons	Barrhead
Alberta Glass Innovations	Edmonton
Alta Aluminum	Lethbridge
Beacon Glass Products Ltd.	St. Albert
Bedrick Manufacturing	Lethbridge and Coaldale
GCW Glass Industries Ltd.	Edmonton
Commercial Aluminum Div.	Calgary
Dorland Commercial Doors L	Edmonton
Environmental Glass Services	Calgary
Gienow Building Products	Calgary
Hlady Home Improvements Ltd.	Calgary
Hlady Shelter Systems	Calgary
Hollyview Aluminum Product	Edmonton
Humphrey Aluminum Windows	Edmonton
Indal Wall Systems Ltd.	Calgary
Johnston Homes	Grande Prairie
Kawneer Company Canada Ltd.	Lethbridge
L & M Aluminum Products Ltd.	Medicine Hat
Lloyd Crystal Glass	Lloydminster
Lux Windows & Glass	Calgary
Oralco Windows Manufacturing	Edmonton
Pigat Aluminum Ltd.	Lethbridge
Sunnyside Aluminum Products	Calgary
Supreme Windows	Calgary and Edmonton
Western Aluminum Prod. Div.	Calgary
Western Architectural Meta	Edmonton
Western Crystal Glass	Lloydminster
Western Windows	Calgary
Willmar Window Industries	Edmonton

Metal Window Frames

All Weather Windows	Edmonton
Blero Engineering & Equipment	Edmonton
Ferguson Glass Western Ltd.	Calgary
Grier Doors Ltd.	Calgary
PPG Industries	Red Deer
Precision Window + Awning	Red Deer
SDI Steel Door Ind. Ltd.	Edmonton
Zemek Steel Manufacturing	Calgary

Wooden Windows

A Fluet & Sons	Barrhead
Award Window Mfg.	Edmonton
Del-Wood Products Ltd.	Delburne
Forest Lawn Sash & Door	Calgary
Four Star Millwork (1977)	Lethbridge
Gergely's Glass Ltd.	Lethbridge
Hera Windows	Red Deer
Indal Building Products	Calgary
Kelly Lodders Woodworking	Bow Island
Loewen Millwork	Edmonton
Lux Windows & Glass Ltd.	Calgary
Mason Windows Limited	Airdrie
Robert Hunt Corporation	Calgary
Southern Alberta Mfg.	Lethbridge
Superior Sash & Supply	Edmonton
Tanco Windows & Doors	Magrath
Western Aluminum Prod. Div.	Calgary
Willmar Window Industries	Edmonton

Pressure Pipe

Abax Energy Service	Calgary
Abco Boiler + Fabricators	Edmonton
Brooks Welding Services Ltd.	Brooks
Chem-Tech Industries Ltd.	Edmonton
Uni-Melt Ltd.	Calgary

Aluminum Pipe

Ecco Heating Products Ltd.	Edmonton

Cast Steel Pipe

Dover Corp (CDA) Ltd. Alta.	Edmonton

Stainless Steel Pipe

Quality Steel Foundries Ltd.	Edmonton
Rainbow Metal Products	Edmonton

Cast Iron Pipe

Trojan Industrial Dist. Ltd.	Calgary
Titan Foundry Ltd.	Edmonton

Concrete Pipes	
Canfarge Ltd. Northern Alberta	Edmonton
Canron Inc. Pipe Division	Cochrane
Conmac Western Industries	Calgary
Consolidated Concrete Ltd.	Calgary, Grande Prairie, Lethbridge, Red Deer, St. Albert
Permanent Concrete	Edmonton
Supercrete (Div. of Canfarge)	Calgary and Edmonton

*Source: Alberta Manufacturers Index, 1986

APPENDIX C

CANADIAN PVC COMPOUNDING FACILITIES

CANADIAN PVC COMPOUNDING FACILITIES

The companies that are currently compounding in Canada are:

Argo Plastics
B.F. Goodrich
Baron Rubber
Cable-Tech Company
Canadian General Tower
Canuck Compounders Inc.
Carlew
Colortech
Dom-Plast
Ferro Industrial Products
H.B. Fuller Canada
Jacobs and Thompson
Jems Manufacturing
National Pro
Paisley Products
Permali
Permalite Products
Plasrec
Polymeric Resins
Polymetals
Rochevert
Rochevert Industries
S. Bam Tooling
A. Schulman Canada
Stedfast
Stewart Group
Terra Nova Shoes
Universal Foam Systems
Vinaflex Canada
Waterville Cellular
Westroc
Wilson-Fiberfil

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